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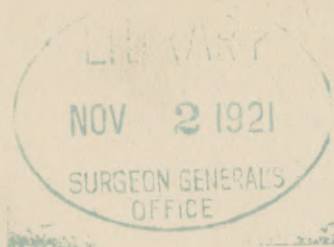
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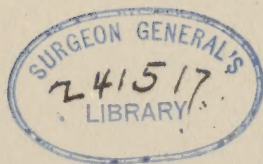
A TREATISE ON CATARACT

BY

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SOCIAL AND ECONOMIC CONSIDERATION OF VENEREAL
DISEASES (SOCIAL TRAVESTIES AND WHAT THEY
COST)," ETC., ETC.

With Original Illustrations



NEW YORK
THE VAIL-BALLOU COMPANY
PUBLISHERS

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TO
DR. SAMUEL E. THOMPSON

EMINENT ALIKE AS A SCHOLAR AND A PHYSICIAN, AND ONE TO WHOM THE AUTHOR
IS PROFOUNDLY INDEBTED, THIS LITTLE BOOK IS GRATEFULLY
AND AFFECTIONATELY DEDICATED

PREFACE

In preparing this little volume it has been the aim of the author to give a general résumé of the subject of cataract, and to place before the reader a synopsis of the most approved methods for the operation and after-treatment of cataract cases. Careful attention has been given to the technic of each operation, with mention of a number of measures indicated to avoid the accidents so common in cataract cases.

Special emphasis has been made of the importance, not only of making a guarded prognosis in advanced cataract, because the possibility of lesions of the fundus, but also of the necessity of examining the eye grounds and recording the findings in cases seen before the lens is sufficiently cloudy to obscure entirely the field, thereby securing valuable data as a later aid to prognosis.

In attempting to generalize the work I have purposely refrained from incorporating in it reports of individual cases.

The cuts in the book are all original, and in preparing them the author has made an effort to present the technic of each step of the various precedures more clearly, perhaps, than they are represented in the average text book.

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San Antonio, Texas.

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A Treatise on Cataract

History of the Cataract Operation

The origin of the treatment of cataract is lost in the haze of antiquity. Among a number of ophthalmic instruments found in upper Egypt is a needle similar to the ones used by the couchers of Medieval Europe, and this relic of ancient surgery has led many antiquarians to believe that the Egyptians were familiar with the cataract operation. That the ancient Greeks attempted to treat cataract is proven by the writings of Celsus, and an exhibit of ancient surgical instruments to be seen in the British Museum demonstrates beyond a doubt that the practice of depressing cataracts was common among the Romans of an early period.

The cataract operation performed by the surgeons of the Renaissance was couching, a practice executed after the method of the ancients. This was a simple depression of the lens into the vitreous by means of a needle thrust through the cornea. The operation was done with the patient sitting, and with no regard for cleanliness. The results were often disastrous, for if the eye was not lost from infection, a glaucoma usually set up and soon terminated vision. If the patient escaped glaucoma and infection the lens would sometimes rise to its former position, thus reobscuring the vision. The couchers of cataracts were unscrupulous itinerants who became generally known throughout Europe as "eye destroyers," a term frequently used by the Dresden Surgeon, George Bar-tisch, 1535-1606, in his attacks upon them.

The first European oculist of whom we have any definite knowledge was this same George Bartisch, a German barber surgeon, who in 1853 published a book on diseases of the eye, profusely illustrated by wood cuts. Bartisch made a forward step in the evolution of the cataract operation but he did not understand that cataract was an opacity of the crystalline lens itself. Instead, he taught that it was a "skin" or pellicle within the capsule. It was not till 1706 that Brisseau discovered, while doing a post-mortem, that cataract was a cloudiness and hardening of the lens substance.

As a substitute for couching, Bartisch instituted a method which has since been known as reclination but, though its author made extravagant claims for it, its improvement over the old operation was not sufficiently great to mark an epoch. Bartisch performed this operation by introducing a needle through the sclera about six millimeters behind the sclero-corneal margin. The point of the needle was drawn across the posterior capsule thus rupturing it. The needle was then slightly withdrawn and thrust between the iris and the lens. As soon as it was seen to appear behind the pupil its handle was carried forward, thus turning the lens backward upon the floor of the eye ball. As with the couching operation nearly all eyes succumbed, following this procedure, as the displacement of the cataract backward had the same effect which would have resulted from any other foreign body within the vitreous.

The Bartisch operation often caused a dislocation of the lens into the anterior chamber, an accident usually brought

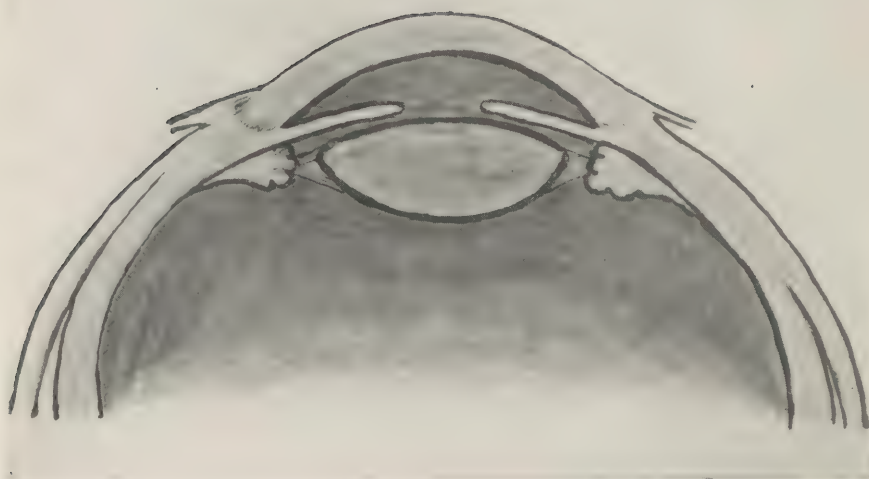


FIGURE 1

Diagrammatic cross section of the eye showing the contour of the lens and its relation to adjoining structures.—Author.

about by an attempt at tearing the posterior capsule previous to reclinacion, and it was following such an accident that Stephen Blaukaart, in 1688, removed the lens by an incision through the cornea. Blaukaart's case is the first cataract extracting on record. Taking his cue from Blaukaart, Jacques Daviel in 1748 originated the modern treatment of cataract by extraction of the lens. In 1752 he reported to the Royal Academy of Surgery one hundred operations thus performed. Before his death, in 1762, it is said that he had done four hundred and thirty-four extractions with but fifty failures. Daviel began his corneal section with a small triangular scalpel after which he enlarged the incision with a thin bladed, curved scissors. His section was always made downward. With a sharp pointed needle he then punctured the anterior capsule, and after elevating the corneal flap with a spatula he forced the lens out by pressing upon the lower lid. Following the extraction extraneous pieces of lens matter were freed from the anterior chamber, either by using the spatula as a spoon or by stroking the cornea with it in much the same manner as is practiced by the modern surgeon.

Daviel's operation for cataract was the first important uplift given to ophthalmology since the days of Galen. In spite of this fact he was bitterly attacked from all quarters and his operation was assailed by the leading ophthalmologists of Europe, which goes to show to what a degree surgical practice may be controlled by conventional habits of thought.

No further important advance was made in the cataract

operation until Albrecht Von Graefe, 1828-1870, introduced his combined method of extraction. In addition to a corneal section accompanied by a conjunctival flap, Graefe made a broad iridectomy. Previous to this time an iris, prolapsed at the time of extraction, was placed in position, only torn shreds being clipped off.

"The results of Von Graefe's linear section," says Fuchs, "were in fact much better than those which the earlier methods had given. Suppuration of the wound in particular, had become less frequent. But yet the method had its dark side, too. Its performance required more operative skill, and the delivery of the lens was made more difficult, owing to the slight tendency to gape that the wound possessed. Other disadvantages arose from the peripheral situation of the section, which brought the latter, especially at its extremities, close to the zonula and the ciliary body. Prolapse of the vitreous was frequently met with, and also inclusion of the limbus of the coloboma in the wound. While suppuration of the wound proved to be less frequent, iritis and irido-cyclitis became proportionately more common, and in consequence, sympathetic disease of the other eye was observed more frequently than before. These facts induced operators to depart more and more from this section, which was felt to be too peripheral in its situation, and in particular led them to place the extremities of the latter near the cornea. If Von Graefe's original section as Von Graefe himself gave it, was itself not a pure linear incision, this is still more the case with the section as it was subsequently performed. It had become a curved section, forming an

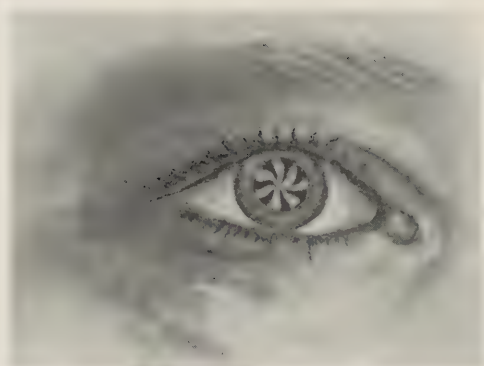


FIGURE 2

Above: Immature cataract as seen by reflected light.
Below: Same seen by aid of transmitted light.—Author.

arc of small altitude. Under this somewhat modified form, soleral extraction soon became the method that was generally employed."

Graefe, during his life, performed over nine hundred extractions for cataract with only five per cent. of failures, a record of which any modern operator might be justly proud. Aside from the aseptic principles under which the operation is now done, and slight variations in technique, there have been no essential improvements made since the days of this great German ophthalmologist.

The Intracapsular Operation

It is not known who was the first to perform the operation for the removal of cataract in its capsule. It is thought by some that the linear extraction as performed by Daviel was in reality an intra-capsular operation, though nothing written by Daviel is in evidence to support this view. Sharp, an English surgeon, briefly describes an operation for cataract and though he does not mention the capsule of the lens he suggests a method of extracting the lens by pressure with the thumb. In his description of the operation he mentions the expulsion of the lens as a second step, and this has led some surgeons to believe that he practiced the intracapsular method of extraction.

The operation for removal of the opaque crystalline lens in its capsule was practiced extensively by Hermann Pagenstecher, his first operation of this character being done in the year 1866. His results in uncomplicated cases were

said to have been very brilliant but because of the large number of eyes lost by expulsion of the vitreous the operation was eventually abandoned by all except its originator. Pagenstecher's method consisted of introducing a small silver spoon behind the lens and then exerting pressure upon the cornea with a spatula so as to cause the lens to glide upward into the bowl of the spoon.

Following Pagenstecher, though differing with him in technique, McNamara, Wright and Andrews performed and described in writing operations for the removal of the lens in its capsule.

In 1871, the Native assistant to Col. Mulroney, then stationed at Amristsar, India, read a paper at Calcutta describing the intracapsular operation as done by his chief. From this time until the present various modifications of Mulroney's operation have been done in India, but the method has only become world known through the efforts of Col. Henry Smith, who in 1917 had performed the operation on over 30,000 cases in his Indian Clinic.

Anatomy of the Lens and Capsule

The crystalline lens is a homogeneous, transparent bi-convex body which at birth is almost of fluid consistency. Later its protein element is increased, giving it a greater density, this density increasing from year to year. Its position is directly between the posterior portion of the iris and the anterior portion of the vitreous humor. Its anterior surface is slightly curved. Posteriorly the curve is greater than anteriorly. Passing from the anterior to the

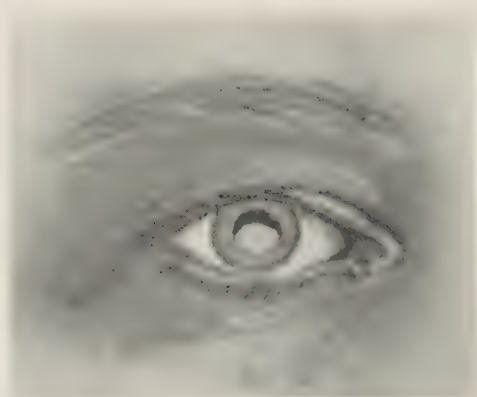


FIGURE 3

Above: Calcareous lens (exaggerated).
Below: Partial dislocation of the lens downward.—Author.

posterior poles of the lens is an imaginary line known as the axis of the lens.

At birth the lens is colorless, but a yellowish tinge begins to be seen at puberty. This tinge increases until senile life when the normal lens becomes of a greyish amber color. In the phenomenon known as cataract these alterations in the color of the lens are more marked than are those found in normal senile lenses, which, as suggested by many authors, may be the result of these changes coming on early but manifesting themselves only in late adult life by marked coloration and density. In addition to changes in density and color, an alteration in the shape of the lens structure itself occurs during life. In infancy the lens is smaller and more globular than it is in adults, its growth throughout life being continuous. An explanation of this phenomenon is given by Priestly Smith, as follows:

“The lens is derived from the cuticular epiblast and its mode of growth is analogous to the cuticle. But its cells, unlike those of the cuticle, are not cast off as they grow old: they are laid down, layer upon layer within a closed capsule, the younger fibres surrounding the older. In consequence of this unique arrangement, and in spite of the shrinking of the older cells which form the nucleus, the growth of the lens does not cease with those of the rest of the body, but is continuous unless some morbid process intervenes, through the whole period of life.”

From infancy to old age the substance of the crystalline lens may be said to be in constant change. Almost fluid at birth, its structure gradually takes on density until old

age appears when it may become solid and even calcareous. At a very early age a lenticular nucleus forms and becomes denser as the years pass until it takes on the normal consistency of adult life.

The lens is surrounded by a thin elastic membrane known as the capsule. It is epithelial in structure, being slightly more friable at its posterior portion. This is responsible for the fact that the anterior portion more readily resists the touch of an instrument than does the posterior portion. The fibres of the equator of the capsule blend with these of the ciliary processes.

The lens capsule is also subject to changes which are governed by age. At birth it is colorless and highly elastic. This elasticity disappears in a measure as age progresses and the substance of the capsule also takes on changes in coloration similar to those found in the lens itself. The distinct haziness of the pupil, as seen in elderly persons, is largely due to the amber tint imparted to it by the lens capsule.

Definition of Cataract

The term cataract is used to designate several types of opacities of the crystalline lens and its capsule.

Varieties

Cataracts are classified anatomically as:

- (1) Lenticular
- (2) Capsular
- (3) Capsulo-lenticular



FIGURE 4

Proper way of holding Von Graefe knife.

Clinically they are spoken of as:

- (1) Senile
- (2) Congenital
- (3) Traumatic
- (4) After cataract

All senile cataracts may be roughly divided into cortical cataracts, a cloudiness or loss of transparency of the cortex of the lens and nuclear cataracts, a hardening of the nucleus of the lens with opacity.

In the cortical variety the substance of the lens surrounding the nucleus becomes opaque. This type of cataract is the one usually found in the individual under sixty years of age. The older the patient is before cataract begins the more liable he is to the central or nuclear type. Cortical cataract is a partially opaque cortex through which the nucleus may be seen with the ophthalmoscope as a dense yellow spot. As ripening progresses the cortex may shrink materially, the nucleus having the appearance of being surrounded by a heavy veil. At this stage the lens is said to be overripe, and the patient sometimes notices he sees slightly better than formerly, this being due to the fact that light rays are penetrating the cortex. A very marked difference may occur in the nature of the lenses in the same individual. I have observed a number of times a cortical and a nuclear cataract in the same patient.

In very rare instances the nucleus moves about in the cortex, a condition known as Morgagnian cataract. In this variety of cataract an unusual optical phenomenon may be observed. The patient may see large objects re-

markably well for a few moments at a time, this brief period being followed by the usual obscuration of vision.

Sometimes the process of ripening of senile cataract is accentuated by a too rapid abstraction of the fluid of the lens substance and a diminution of its supply, which interferes with its nutrition and transparency. This absorption of the lens substance may be followed by deposits of phosphates or carbonates of lime within the substance of the lens and the establishment of calcareous cataract. These deposits early prevent the admission of light rays and, as in the case of black deposits in the lens, may interfere materially with diagnosis. Senile lenticular cataracts begin as a cloudiness of the lens structure in which changes in density and color are abnormally progressive. At first there seems to be but slight alteration of the substance of the lens. Much light is admitted to the eye and there may be for years little embarrassment to vision. Usually the nucleus of the lens is the first to become thoroughly opaque.

Causes of Senile Cataract

That opacities of the crystalline lens may be influenced by heredity cannot be doubted. In a great number of instances whole families have been known to become cataractous as old age draws near. Several children in the same family whose parents have been cataractous are often seen to have congenital cataract, this phenomenon, according to De Schweinitz, being transmitted through the female line. In the congenital form of cataracts it is not

uncommon to have some other defect of the eye which may be traced to an ancestral origin.

Occupations which necessitate looking at intense light for long periods predispose to cataract. Glass blowers and stokers are known to frequently develop the disease. The condition is thought to be more common in the desert regions of the Southwestern states where the glow from the sun is continuous and excessive.

Certain toxic agents are known to produce opacities of the crystalline lens. Rabbits fed upon naphthaline develop cataract in a few hours. When the naphthaline feeding is discontinued the lenses clear up completely. Ergotism is often complicated with cataract. During great European epidemics of this disease, then known as St. Anthony's Fire, large numbers of the victims of ergotism became blind.

Cataracts sometime develop simultaneously with disease of the optic nerve, from a lightning shock. I have had in my practice one such case. It is probable that the rapid absorption of actinic rays has something to do with the molecular changes which resulted in opacity of the lens.

Cataract has been known to follow in the wake of the continued fevers. It is common in patients who have diabetes, and is not unfrequently associated with Bright's disease.

Some writers have held forth the theory that the difference between the senile changes in the normal lens and senile cataract itself is only one of degree, this supposed fact making it impossible to decide when the one ends and

the other begins. As pointed out by De Schweinitz, accommodation strain is probably a pronounced factor in the production of senile cataract. A large number of senile cataracts are found in individuals known to be hyperopic and astigmatic, the preponderance of these cases being in uncorrected astigmatic cases of high degree. This is a very strong argument in favor of wearing correcting lenses in all cases of errors of refraction. Keeping in mind the fact that excessive light has, in many cases, been known to produce cataract, the various lenses for the absorption of actinic or heat rays, now on the market, may be used to advantage while persons are being exposed to unusually bright lights.

Symptoms of Senile Cataract

In incipient cataract a number of premonitory symptoms may be observed by the patient before any change can be seen by the unaided eye.

Because of the swelling of the lens the patient is usually much gratified to learn that he sees ordinary print without his reading glasses, hence the lay term "second sight." Gradually a cloudiness of vision manifests itself; objects are seen as if through a fog. The patient complains of the sensation of having spots or cobwebs before his eyes. He is now apt to see badly in bright lights which contract the pupil but gets along easily at night and in cloudy weather. Diplopia often occurs as the disease progresses and objects are seen in distorted and fantastic shapes. These visual disturbances vary greatly in different pa-



FIGURE 5

Proper way of holding the iris forcep.

tients, some being fortunate to retain a fair degree of vision until their opacities are far advanced.

The degree of blindness which the patient is subjected to, during the maturation of a cataract, will depend largely upon the site at which the greatest degree of opacity exists. Except in very dense cataracts the patient will be able to indicate the point at which a light is burning in the room, and will recognize the figure of a hand when passed between his eye and a window at the distance of eighteen inches. A very marked opacity may be present at the periphery of the lens and the patient continue to attend to his daily routine of duties as if nothing had occurred. On the other hand, should the same degree of cloudiness be central, he will be almost helpless from loss of vision. When the cataract is thoroughly ripe the patient's vision is reduced to mere perception of light, regardless of the situation of the densest area in the lens. When the condition remains unaccompanied by other complications, such as opacity of the vitreous and changes in the retinal vessels and walls, the light perception is fairly acute. Should it be found absent it would indicate complications so grave as to make the case inoperable.

Patients developing cataract often complain of a burning sensation in their eyes and may actually develop a marked conjunctivitis during the progress of their disease, this being due to the strain caused by imperfect transmission of light. Frequently the conjunctivitis is accompanied by a marked degree of pain.

Photophobia is often present at the beginning of cataract and patients will be seen to avoid the light by shad-

ing their eyes with their hands. Subdued light gives a sense of relief because it admits of expansion of the pupil and the admission of light rays around a cloudy nucleus with accompanying vision devoid of pain.

The primary swelling of the lens is in time followed by flattening of its surface due to an atrophy of the lens structure itself. Occasionally, during the process of ripening, the lens takes on a hue so dark as to be classified as black cataract. During January of this year I removed from a patient 83 years old a cataract in which the lens substance was almost entirely black at the nucleus, the coloration grading off to a light brown at the circumference. This patient had been blind for over five years, during which time his condition remained undiagnosed because of the natural color which his pupil presented.

Diagnosis of Senile Cataract

In the hands of the ophthalmologist all tests for cataract are secondary to the findings of the ophthalmoscope. By reflecting the light into the eye with the ophthalmoscope the pupil will be seen to be greyish or even white depending upon the degree of opacity present. The lens, seen from transmitted light with the ophthalmoscope presents a dark, heavy appearance into which striae of light seem to bear from the periphery. The cataractous lens under oblique illumination presents practically the opposite picture, the peripheral striae being dark.

A blunder, which unfortunately has been made by a number of experienced men, is that of mistaking the cat-



FIGURE 6

Proper way of holding the iris scissors.

aractous lens of absolute glaucoma for true senile cataract. This error can only occur when the eye has been examined in the most superficial way; for the lusterless cornea, the sea green pupil, the motionless iris and the increased tension would at once indicate a diagnosis if the examination were not cursory and indifferent.

The Responsibility of the General Practitioner in the Diagnosis of Senile Cataract

A general practitioner said to the writer some time ago that he gave little thought to eye diseases and felt practically no responsibility in his cataract cases for these he shifted to the shoulders of the ophthalmologist, to whom he sent them when ready for operation. Unfortunately, this is the attitude taken by a large per cent. of the medical profession and one which is altogether unjustifiable, as demonstrated by the hundreds of glaucoma cases which are every year mistaken for immature cataract. This error results not only in destruction of vision but often in loss of the globe as well.

The largest per cent. of the population of this country live long distances from the cities and do not have access to the office of the eye surgeon. Under such conditions it would seem imperative that the general practitioner should correctly diagnose eye conditions, especially those of such grave importance as iritis, glaucoma and cataract. By observing a few simple principles which I will attempt to illustrate here, no one can easily be mistaken in recognizing cataract and differentiating it from glaucoma, optic

nerve atrophy, glioma and other vision-destroying diseases.

The general practitioner in the rural districts should not only be able to correctly diagnose cataract, but he should be prepared to advise his patient when to have the operation done. A common error is to wait until the lenses are over-ripe and the retina has become insensitive from disuse. I have seen several such cases which might easily have been successfully operated upon had the patient not waited too long. It seems to be the general impression that a partly ripe cataract cannot be removed successfully, and this is often responsible for the over-ripe cataracts we see. The facts in the case do not bear out the validity of this opinion. We have seen partially ripe cataracts remain stationary for years, the unfortunate possessors being deprived of their vision for many dreary months while they waited for the ripening of their lenses, the retina daily becoming less sensitive from disuse. It is decidedly better to operate these cases after the process of ripening becomes stationary, than to allow them to wait and commit them to partial blindness for months or even years, without any assurance that the long looked forward to "ripening" will be complete. The objection that secondary cataracts, which often occur in these early operated cases, subjects the patient to unnecessary risk is not well taken in these days of surgical technique, which is so well perfected that the globe can be entered repeatedly with little danger to its structures.

There are few conditions which are as simple to diagnose as that of senile cataract. With the ophthalmoscope



FIGURE 7

The puncture; initial step in performing the corneal section. Demonstration upon model.—Author.

it is done in a moment. Frequently, however, the general practitioner is not familiar with this instrument, so let us suppose that we are to examine a case without any equipment, and at the same time be as certain in our diagnosis as if we had all the modern paraphernalia at hand. First, let us take a candle and hold it in front of the pupil of the eye to be examined. The flame of the candle thus held shows three images in the normal eye, one caused by the cornea, one by the anterior surface of the lens, and one inverted picture on the posterior surface of the lens. If the lens is opaque, a shadow of the flame will be seen on the cornea; a very faint one will be seen on the anterior surface of the lens, but there will be no third image. In other words, two shadows, a bright and a dim one, instead of three bright ones, will be reflected from the pupil. This is an absolute and never-failing test for cataract.

If the candle be held beside the pupil a shadow of the iris will be seen on the opaque lens. This is never seen except when opacity of the lens exists. The more opaque the cataract is the darker will be the shadow. The test is infallible. Now let us take an ordinary oil lamp or electric globe fitted with a reflector and direct the light into the eye. No red reflection or "glare" is seen if the case is one of cataract. There will be noticed, however, a greyish condition of the pupil and "flows" or striæ will be seen in the lens. Before making these tests it is necessary to dilate the pupil somewhat. Atropin, however, should not be used for this as it predisposes to glaucoma. A mild mydriatic should be selected and to make the procedure

safer it is better to instil a weak solution of eserine in the eye following the examination.

Case Record Notes in Incipient Cases

In cases of incipient cataract, before the lens has become too dense to be penetrated by light rays, the ophthalmoscope should be used to explore as well as possible the fundus, and the results should be noted and filed away for future reference. When the case is first seen after the fundus is obscured much may be ascertained by a close inspection of the external eye. Complications of the choroid are frequently revealed by the state of the iris. In chronic conditions the iris usually loses its luster. This is particularly to be noticed in light complexioned persons whose irides are grey or light blue. Modifications of the pupillary reflexes, when observed, are of great aid in formulating a prognosis. In a cataractous eye, otherwise normal, very little change may be seen in the pupillary reflex. If, upon examining an eye with cataract the pupil be covered and then exposed to a moderately bright light which affects it so little that it stands almost motionless, it may safely be said that the internal structures of the eye are at fault, and a very guarded prognosis should be given.

The Question of Operating One or Both Eyes

Without the circumstances are unusual only one eye should be operated upon at a sitting even if both cataracts



FIGURE 8

The corneal section showing the puncture and counter puncture.
Demonstration upon model.—Author.

are mature. There is always the possibility of infection or some other untoward result following a cataract operation which, should any one of the possible accidents occur, might involve both eyes resulting in their loss. For this reason it would be a matter of poor judgment to risk both eyes at a single operation. To do so would be to recklessly throw away thirty per cent. or more of the patient's chances for vision.

Occasionally the surgeon will be informed by the patient, or members of his family, that one operation only will be submitted to. A decision of this kind upon the part of the patient is not right in cases where the operation has been arranged for, except as a result of great financial sacrifice or when the patient lives in parts remote from medical centers. In such instances a double operation may be done without hesitancy.

Preliminary Iridectomy as a Means of Improving Vision in Patients Developing Cataract

In the nuclear type of cataract a great deal of improvement may be made in the patient's vision by producing an artificial pupil by iridectomy. Frequently this may be done many months before the lens is ready for extraction. I have had patients with nuclear cataracts who successfully did their work for long periods after I had performed iridectomy, who, before this simple procedure, were completely incapacitated by faulty vision. This operation, in my opinion, is never contraindicated. There is absolutely less risk of iritis following a simple iridectomy than

when a combined iridectomy and extraction are done, besides the procedure lessens the possibility of glaucoma.

Usually one Cataract more advanced than Other

As the ocular changes which interfere with the success of a cataract extraction are numerous all available methods of testing the general condition of the eye should be practiced. With senile cataract both eyes are affected simultaneously as a rule, though fortunately for the patient the process in one lens is usually more advanced than in the other. This often enables the patient to retain useful vision in one eye till the cataract in the other eye has ripened and has been operated upon.

Arrestation of Cataracts

While a number of ophthalmologists throughout the country are more or less emphatic in the contention that senile cataract may be arrested, and even cured by treatment, there is no reliable evidence to substantiate this claim. A well-known pharmaceutical firm has long had on the market a preparation for the restoration to normal of the partially opaque lens, and though their claims are supported by over one hundred American ophthalmologists, the results cited by these observers are entirely too extravagant to be accepted as truth. It is entirely possible that a corneal cloudiness resulting from long continued inflammatory disease of the eye may clear up spontaneously as the inflammation subsides, or that a slight haziness of the

lens resulting from diabetes may disappear while the patient is under observation, and this fact, no doubt, has led several conscientious physicians to believe that a partially developed senile cataract has been cured. With the exception of correcting lenses and due precaution against using the eyes beyond the period of fatigue there is probably nothing else to be done toward mitigating, in any way, the progress of true senile cataract.

Conditions Contra-Indicating Operation

Advanced tuberculosis with cough is a bar to the cataract operation because of the improbability of favorable union of the corneal wound, and further because of the danger of expulsion of the vitreous during the act of coughing. Any character of violent and chronic cough will mitigate very greatly against favorable results.

Chronic blepharitis or eczema of the eyelids should always receive appropriate treatment before the operation is attempted. With chronic trachoma operations for cataract are hopeless.

Chalaza, tarsal cysts and styas must not be present on the lids of the eye to be operated.

Entropion with trachiasis is always accompanied by an inflammation of the conjunctiva, with secretion, and should be corrected by operation many weeks before an extraction for cataract is performed.

Chronic purulent dacryocystitis is a grave menace to an eye about to be operated for cataract, and when it is possible to obtain the patient's consent the lachrymal sac

should be removed before the cataract is operated. When an operation for the removal of the sac is refused the canaliculus may be tied off with silk with some advantage before the extraction is attempted.

Patients with a recently acquired syphilis should receive appropriate treatment, and give a negative Wassermann, if this result is possible, before any surgical interference with the eye.

Patients with chronic keratitis, recurrent iritis or inflamed eyes from any cause are poor cataract risks.

A patient without light perception should never be operated upon for cataract. A diseased lens never entirely shuts out light from the retina. Even when perception of light is present, but is very feeble, the operation may be followed with very disappointing results.

Decreased tension of the globe with iris slightly tremulous may indicate deficient vitreous. An operation performed upon such an eye would be liable to be followed by detachment of the retina and intro-ocular hemorrhage.

No patient should be operated upon for cataract who has pyorrhea with alveolar abscesses. It has been pointed out by a number of observers that infections surrounding the teeth may cause constitutional disease. Patients with foci of infection in the mouth have been known, in many instances, to develop arthritis, acute appendicitis and even abscesses in remote portions of the body. In the latter cases examinations under the microscope have demonstrated the same type of bacteria as that of the original focus, pointing clearly to the likelihood of the infection being carried by way of the blood stream.

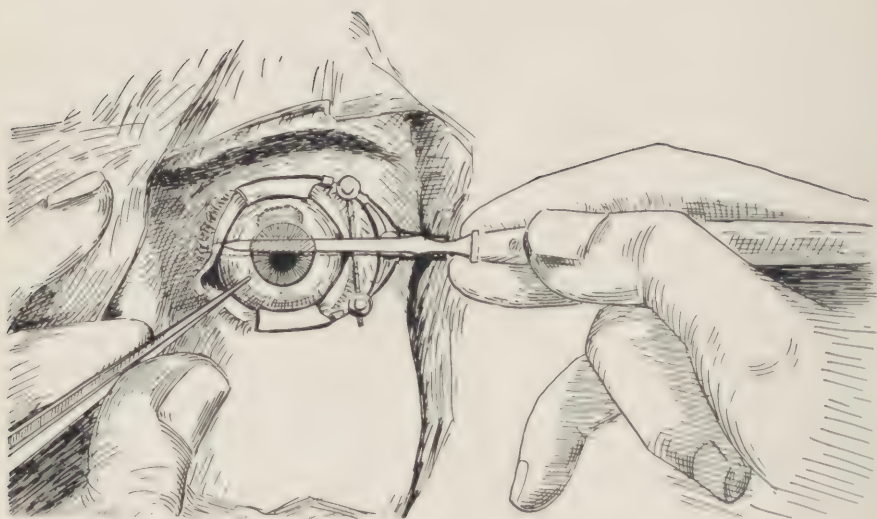


FIGURE 9

The puncture and counter puncture of an unambidextrous surgeon showing a very frequent and sometimes fatal misstep—the pricking of the unanesthetized lid with the point of the knife with consequent flinching of the patient.—Author.

Rosenow, of the Mayo Foundation, has made an exhaustive study of focal infections of the mouth and their relation to constitutional disease, and in the light of his elaborate laboratory experiments there can no longer be any doubt regarding the mooted question of absorption of bacteria by the blood as well as by the lymph streams. With the conclusion of Rosenow in mind it would certainly seem hazardous to operate for cataract, in old and debilitated patients, with mouths harboring virulent foci of infection. A great many operators in the past have been astonished to find their operated cases of cataract with fulminating infections which could not be laid at the door of a faulty technique. There can no longer be any doubt that septic mouths were responsible for many of these unfortunate terminations.

A patient, then, who presents himself for operation should have his mouth taken care of and the sound teeth should be cleaned. Pyorrhea, if present, and it almost invariably is in the aged, should be treated, if the disease has not passed the curable stage. If a cure is unlikely the teeth should be removed and sufficient time be allowed for healing before the extraction is performed.

The Wisdom of a Guarded Prognosis in Cataract Cases

Before an operation for the extraction of cataract is performed the patient or the patient's friends should, by all means, be made familiar with the possibilities of complications in even the most favorably appearing cases. Should any conditions, however slight, be present which

would make the result of the operation questionable this fact should be clearly and intelligibly stated. This is important because it will mitigate the patient's distress should a success not be obtained and will relieve the surgeon of much embarrassment, to say nothing of the possibility of his being censured.

The Pupil in Cataract Cases

The size of the pupil should not be overlooked in arriving at a prognosis in cataract cases. An expanded pupil which responds poorly, or not at all, to light should make the examiner conscious of the possibility of some deep seated disease of the eye. This is particularly suggestive of glaucoma if the tension be increased in the slightest degree. It must not be forgotten, however, that the pupil may vary in size in different patients as a result of their individual temperaments. Habitual morphine users have permanently contracted pupils with diminished reflexes. This peculiarity has often led examiners into error when dealing with unsuspected drug takers. Similar mistakes in prognosis have been made by physicians who have examined patients with pupils dilated by a mydriatic who, for personal reasons, have denied that a drug had been used in their eyes.

The Education of the Patient Preparatory to Operation

The education of the patient, before the operation is important. It will be necessary to calm the fears of a



FIGURE 10

The corneal section as made by the left hand. Demonstration upon model.—Author.

patient of nervous temperament, relative to the operation, before he goes to the operating room. Usually his apprehension will subside upon the assurance by the surgeon that his operation will not be attended with pain. He must be told to lie perfectly passive, and not to "squeeze" his eyes. Many eyes have been ruined by the surgeon's neglect to warn the patient regarding this very important precaution upon his part. I frequently start, days before the day of operation, to teach the patient to look up and down in a quiet manner. This education is of much importance and does away with the jerking movements of the eye too frequently seen at the time of operation.

Preparation of the Patient

In view of the fact that a wound is about to be inflicted upon an exceedingly sensitive and delicate organism it is obvious that the patient's general condition should be made as perfect as possible before the operation is attempted. Patients habitually constipated should have a laxative daily for a period of weeks before their extraction day. Debilitated patients should undergo a process of reconstruction brought about by proper feeding, gentle but regular exercise, tonics and general care. The patient's blood pressure should be taken and if found abnormally high every effort should be made to reduce it as much as possible. The patient's age must be taken account of and this will govern largely the course to be pursued.

One o'clock in the afternoon is the time usually selected by me for cataract extractions. I instruct the patient to

have a warm bath at his home the previous evening and to go to the hospital in the morning. This is preferable to a bath at the hospital and a night spent in anxiety and worry in a strange bed. It is well to remember that the less done to him before the operation the less demoralized he will be. Too much fussing and flurry at the hospital only adds to his nervousness and impresses him unnecessarily with the gravity of his operation. After he enters the hospital a gentle scrubbing of his face with green soap, a boric acid irrigation of the eyes and a sterile dressing is all that he will need.

Patient to be led to Operating Room

It is preferable to have the patient led rather than wheeled to the operating room because the psychic effect produced by being pushed about on a vehicle which is novel and untried is not good. A stool should be provided to assist him in getting upon the table.

After the patient is comfortably placed upon the table the preliminary dressing may be removed and the eye prepared by gently irrigating it, after which the local anesthetic may be dropped in the eye.

General Consideration regarding Operating Room and Surgeon's Dress

No special requirements, except a good light, are needed for the operating room. Any operating table that is not unstable will answer the purpose. The ordinary surgical

cleanliness should prevail. The surgeon's dress should be the same as for any major operation. It seems unnecessary to say that he should wear a gown, yet I have seen several surgeons, one of international reputation, operate in their shirt sleeves. The surgeon's head should be covered with a cap. Seborrhoeal scales falling from the scalp will not add to the asepsis of the field. By all means his mouth and nose should be covered with a gauze mask. The surgeon's mouth may not be the embodiment of cleanliness and his commands, if his mouth be not covered, may be accompanied by a spray of germs. I believe that it is better to work without gloves; for a cataract extraction, more than any other operation perhaps, demands dexterity. The hands, then, should be prepared with the most scrupulous care and must be thoroughly dry so that the rinsing solution will not gravitate down the handles of the instrument and contaminate them. Human hands cannot be boiled and, though prepared with great caution, should be kept as far from the cutting edge of instruments as possible.

Regarding Surgeon's Personal Discipline

The surgeon who undertakes cataract extractions should have himself under perfect control. He must have sufficient self-reliance but should guard against being over confident. He should be cautious and reserved in judgment but not timid. What is generally spoken of as poise is an asset which is invaluable to one attempting the delicate surgery of the eye. More than one internationally known

ophthalmologist is a failure, as far as executing eye surgery is concerned, because of his lack of poise. The inexperienced surgeon particularly is apt to lack the nervous stamina necessary to success as an eye operator. The very fact that friends of the patient or possibly other surgeons are present may unhorse him. Feeling the gravity of the responsibility thrust upon him, and being conscious of the existing scrutiny of those present, he may become intoxicated with emotion, his trembling fingers indicating that he has not been schooled in mental discipline and that he lacks poise. Over confidence in a surgeon is a mental habit more reprehensible, and even more fatal, than is timidity. I have seen eyes ruined by improper counter punctures, split corneas, collapsed irides and other accidents at the hands of men whose over confidence had led them into a swaggering and spectacular technique without proper regard for the niceties of surgical detail. The surgeon should regulate his habits of thought and of bearing so that he may always be able to assume command of himself. He should seek to live so that he can operate as a master of the situation, with a cool head and a steady hand. If such stimulants as alcohol and such diversions as midnight carousals interfere with the steadiness of his good right arm and the consequent welfare of patients intrusted to his care, he should be willing to give up his surgery or his habits. A patient craving vision stakes his all on the ability of his surgeon and if the surgeon is not physically and mentally qualified to perform effective work, it would be the part of wisdom to admit the fact and not attempt an operation which promises only failure.



FIGURE 11

Method devised by Jameson of replacing and protecting the iris after it has fallen in front of the knife. Demonstration upon model.—Author.

Stimulants, such as coffee, tea and tobacco seem not to interfere with the nervous constitution of certain individuals but where they are known to produce unsteadiness of the hand their use should be abandoned.

Practice Necessary to Good Technique

It would be well for the surgeon contemplating cataract extractions to familiarize himself with the technique of the operation by first operating upon animals' eyes. Various masks are on the market which are mechanically arranged so as to hold the eye in position. Pig's eyes simulate the human eye more than do the eyes of any other animal and for this reason they are to be preferred. Other animals' eyes answer the purpose very well if pig's eyes are unobtainable. During a vacation I once operated upon the eyes of over twenty jack rabbits, using an improvised mask for the purpose. In operating animals' eyes one must be very careful not to vary from the technique which would be used upon the living human eye, otherwise faulty habits may be formed which will mar rather than improve one's technique.

Don'ts

The following *don'ts* formulated by Beard in his "*Ophthalmic Surgery*" may well be studied by any doing cataract extractions.

"Don't get shaky. Pick up the knife, make a few finger movements with it and, if the hand is turning craven,

just call a slight halt, resort to a little inward discipline, and one can usually regain his composure. A colleague once told me that when he found himself becoming demoralized on the eve of an operation, he walked to the window and, while apparently taking in the view, proceeded to give himself, mentally, a sound castigation, with the invariable effect of restoring his calm.

“Don’t drop cold or hot liquid into the eye during or after the operation—have it lukewarm. Don’t let it fall from a height onto the eye and lids, as all tends to produce wincing. Don’t squirt nor fire solutions at the eye, but pour them gently over it, and always warn the patient of your intention. Don’t permit sponges to touch the cornea and disturb the epithelium.

“Don’t begin the installation of the cocain solution until it is known that the operation can follow in not more than ten minutes. Don’t let the speculum fly out of the fingers like a jack-in-the-box while in the act of putting it in position. Get a good, firm grip on it.

“Don’t pry the lids too far apart, for it induces spasm of the orbicularis and increases intraocular tension. Don’t allow the speculum to rest heavily upon the globe. Don’t fail to lift it away from the eye, and with a firm grasp, in removal.

“Don’t use fixation forceps that have a catch, and don’t forget the hand that holds the forceps while fixing the eye. Don’t rotate the eye with the forceps as if it rested with its posterior surface on a transverse vertical plane, but as it is, like a ball that turns on a universal central pivot.

“Don’t seize merely a fold of conjunctiva by which to

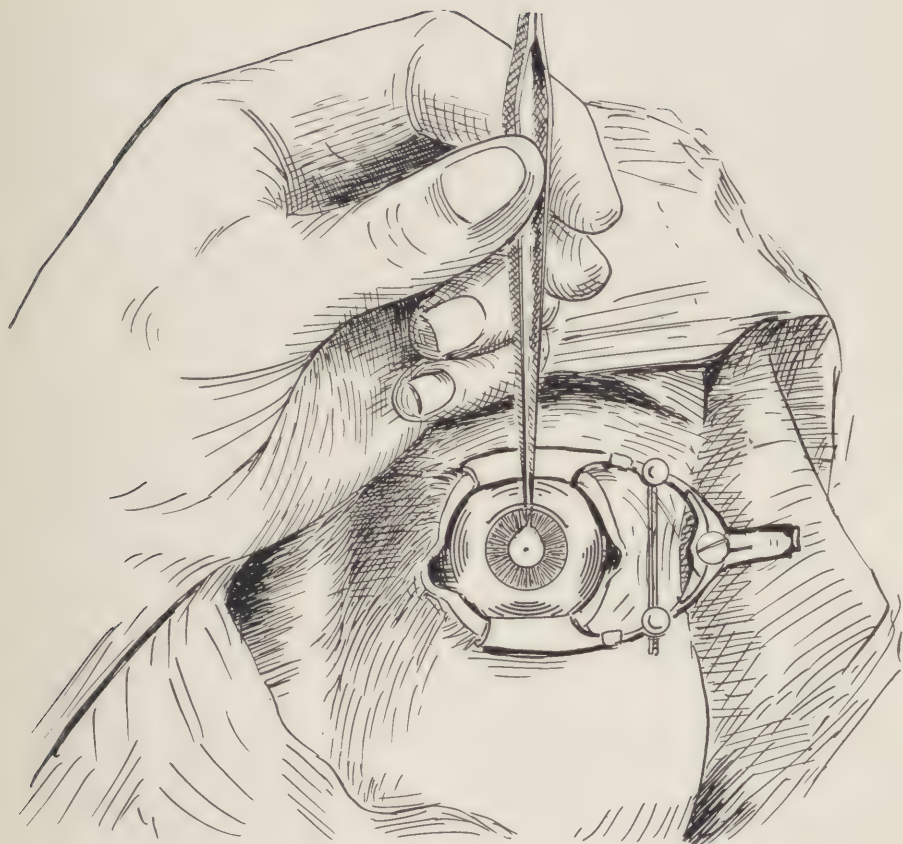


FIGURE 12

Method of grasping the iris with forceps in operation upon left eye where surgeon is not ambidextrous. Section has been made from opposite side of the patient.—
Author.

steady the eye, but in addition, as much as possible of the subjacent tissues and as near as practicable to the cornea. Don't employ fixation after the bulbus is opened unless the need is urgent.

"Don't neglect to test point and edge of both knife and cystotome before they are disinfected, to see that they are sharp. Don't use a knife with long needle-like point—the tip might break. Don't hold the knife so tightly as to cramp the fingers, nor yet so loosely as to cause wavering. Don't attempt either corneal or capsule incision free hand. No matter how steady the latter, always rest the little finger on the patient's face not only for support, but in order to move with him should he stir.

"Don't haggle, fuss, nor hesitate in making the section, yet, while forging steadily ahead, do so with a certain deliberateness. Faulty sections, premature escape of aqueous, etc., come not so often of slowness as of vacillation.

"Don't lose sight of the patient's demeanor. If this be favorable throughout the corneal section, it is apt to be so for the entire operation. If he begins to squeeze, pause, even though in the midst of the incision, and remonstrate with him in a kindly tone, and have the assistant guard closely the brow and speculum.

"Don't take the eyes off the sight of the operation for an instant. Have the assistants so trained that it will not be necessary for the operator to seek instruments and implements, nor to lay them down. Be in the closest touch with the subject, allowing not a single break in that subtle, intuitive current whereby we anticipate a move on his part.

“Don’t scrawl all over the capsule and zonule with the cystotome. Take pains to place the point properly on the cataract just where the opening should begin—not hastily; elevate the handle until the point is sure to have engaged the capsule, then draw it very lightly along, making a definite cut, and note that the lens responds to the liberation by springing forward. If not, it is better to go over it a second time, there and then, trying to improve upon the first effort, than to be obliged to again enter the instrument.

“Don’t triturate the cornea too much with the spoon in delivering the cataract, nor rub it about in an aimless sort of way to get out the cortex. Be sure that the back and not the edge of the instrument is applied. Don’t stop to pick up the extracted lens unless it is caught deftly upon the upper spoon—merely brush it aside until the operation is terminated.

“Don’t have the instrument dripping wet, as the liquid, streaming downward, carries bacteria from the fingers to the eye. Don’t hold instruments in the mouth to disembarass the hands. Give them to an assistant or lay them down.

“Don’t talk any more than necessary, and never with explosive aspiration, to emit showers of germs, even though mouth and nose be covered by a mask.”

Anesthesia

When possible the operation should be done under cocaine anesthesia. Occasionally one finds a patient so

nervous and disturbed by fear that local anesthesia is entirely out of the question. Confronted with such an exigency one has to decide upon a general anesthetic. Ether is especially inapplicable because it causes post operative vomiting, a complication which is nearly always fatal to an operated eye for the reason that during the act of retching the contents of the globe are apt to be extruded. Chloroform anesthesia of short duration may not be attended by vomiting and, therefore, is preferable to ether. Nitrous oxide is by far the best general anesthetic for cataract work. If it is used cautiously by an experienced anesthetist very little nausea occurs and the period of excitation following its use is brief.

Cocaine is the best local anesthetic for cataract work. It should be used of a strength of ten per cent. A weaker solution than this will not produce complete anesthesia of the iris and when the iridectomy is done the patient will be apt to flinch. To my solutions of cocaine I usually add adrenalin chloride, one drachm to the ounce. This is of decided advantage for it lessens bleeding from the wound, if the conjunctiva is cut at the completion of the section, and it also prevents hemorrhage from the iris, with a consequent blurring of the field by an extravasation of blood into the remaining aqueous humor.

Preparing the Solutions

It is well for the surgeon himself to prepare the solutions to be used in his cataract work. If this important matter is left to the dispensary employe, or to the drug-

gist, the surgeon has no assurance that his solution will be sterile.

Druggists, as a rule, have a very poor conception of asepsis and a dirty spatula, or an improperly prepared bottle will render futile the most aseptically performed operation. Some surgeons are in the habit of boiling their solutions after they are sent from the dispensary. This, from an aseptic standpoint, is an important precaution but in my own work I have found that cocaine solutions after having been thus treated are decidedly less efficacious than solutions unboiled. It is not well to use too much cocaine. Three or four instillations of a ten per cent. solution will produce anesthesia. More than this predisposes to hemorrhage at the conjunctival margins of the wound and may cause a cloudiness of the cornea, due to softening of the epithelium. I have seen a surgeon of international reputation strip off the corneal epithelium, during the act of expressing the lens, in an eye over anesthetized. Between instillations the lids should be kept closed in order to protect the cornea.

Instruments

The instruments required in an operation for cataract extraction are few. A speculum, a fixation and an iris forcep, an iris scissors, a spatula, an iris spoon and a knife will meet every need in an uncomplicated case. Any speculum sufficiently curved for its handle to be out of the way of the operator's knife will answer the purpose. There are on the market a number of specula in which the



FIGURE 13

The iridectomy. Iris is drawn well beyond margin of wound. De Wecker's scissors in position preparatory to snipping off section. Demonstration upon model.—Author.

curve is almost absent. The use of such an instrument would certainly be attended with annoying difficulties. It is better to use a speculum provided with a stop attachment, so that no undue tension will be made upon the lids. The knife of Von Graefe is probably the best instrument to be used in making the section. In my opinion, this knife has several advantages which the Beers knife does not possess. It is smaller, less unwieldy, and consequently does not obscure so much of the field of operation. Being thinner than the Beers knife it does not cause so much gaping of the wound with attendant rapid loss of the aqueous humor. This is a decided advantage, for should the aqueous gush out quickly the sudden decrease in the tension of the eye is liable to be accompanied by intraocular hemorrhage. Another disadvantage of a bulky knife is its tendency to stretch and cause trauma to the corneal incision.

The Corneal Section

Anesthesia being complete the speculum is now adjusted. Before introducing this instrument the patient should be told that something is about to be put between his lids to hold them open and that it will not hurt him. He is then instructed to look down and with his eye in this position, the lid is elevated and the upper blade of the speculum slipped under it; next his eye is to be directed upward and during this movement the lower blade is put in place under the lid, after which the stop may be adjusted. The eye is now gently irrigated with a warm solution of

boric acid and the surgeon is ready to proceed with the operation.

The speculum having been introduced, the operation is begun by making the corneal section. If the right eye is to be operated upon the surgeon stands at the head of the table and, with the left hand resting upon the patient's cheek, grasps the conjunctiva, two millimeters below the limbus with mouse tooth fixation forceps. The fixation forceps should be held lightly so as not to produce pressure which might cause a premature emptying of the anterior chamber. To prevent this accident the little finger of the hand holding the forcep should rest upon the patient's cheek, so that the hand may be steadied and undue pressure avoided. The fixation forcep should not have a lock adjustment. Such an arrangement may necessitate some little pressure in its being disengaged, and pressure of any character upon the globe should be avoided. Before the forcep is applied the patient's eye has been put in the proper position by asking him to look down. The surgeon is now ready to make the incision.

The corneal section should be made with great nicety. If it is too small it will prevent the free expulsion of the lens, which, in being delivered, may leave portions of its cortex floating in the anterior chamber. This accident, when it occurs, has a double disadvantage. Lens matter left in the anterior chamber, not being absorbed to any considerable degree by the aqueous humor, will act as a marked impediment to the proper admission of light rays and may also cause iritis by acting as a foreign body.

Before the knife is introduced it should be carefully in-

spected. It is a ludicrous fact that the Von Graefe knife has not infrequently been thrust through the cornea upside down by careless or near-sighted surgeons. When this has happened its withdrawal, preparatory to reversing its blade, has sometimes occasioned a loss of aqueous and such a prolapse of the iris forward that the operation for a time had to be abandoned. The knife, held loosely between the fingers, in the same manner in which a pen is held, is thrust through the cornea while being held at an angle of 45 degrees from the plane of its surface. If this precaution is not observed the point of the knife may glide between the layers of the cornea instead of entering the anterior chamber. The point of entrance should be about one and a half millimeters anterior to the sclero-corneal margin. The knife is now carried across the anterior chamber to a point as nearly as possible opposite to its point of entrance, care being taken that the iris is not engaged, and with a quick but gentle thrust it is made to emerge from the cornea.

As the knife emerges the aqueous will escape and the cornea will fall in slightly toward the iris. The surgeon should now draw the knife back and forward with a sawing motion, avoiding all pressure, and being careful not to pull but to cut. Three or four sweeps of the knife will complete the section.

Sometimes, in very old subjects, a collapse of the cornea has occurred, following the liberation of the aqueous. In this contingency Beard advises that the anterior chamber be gently flushed with normal salt solution, a maneuver which usually replaces the cornea. He further advises

that if a piece of wet absorbent cotton be placed over the section, the anterior chamber will refill in a few minutes, at which time the operation may proceed.

The Question of a Conjunctive Flap

The largest per cent. of American surgeons make a conjunctival flap, though this is seldom done by European operators. This little procedure has advantages to recommend it but it also has its disadvantages. There is no doubt that it makes more secure the corneal incision and that it, to an extent at least, protects the eye against infection. It occasionally happens, however, that the flap turns out, and when this occurs it has a tendency to make the wound gape. The greatest objection to this method is that there is often quite a profuse hemorrhage from the flap, this blood quickly flowing through the corneal wound into the anterior chamber, obscuring the field of operation.

Colonel Smith, who has done more cataracts than any surgeon, objects to the conjunctival flap for the following reasons:

(1) Hemorrhage almost invariably takes place, the blood finds its way into the anterior chamber, thus annoying the operator, not to speak of the manipulations, irrigations and instrumentation it entails.

(2) Inversion of the flap in the anterior chamber of lips of the wound, which is objectionable at any stage of the operation, for it carries mucus, dead cells and tags into the wound, and necessitates manipulation and instru-

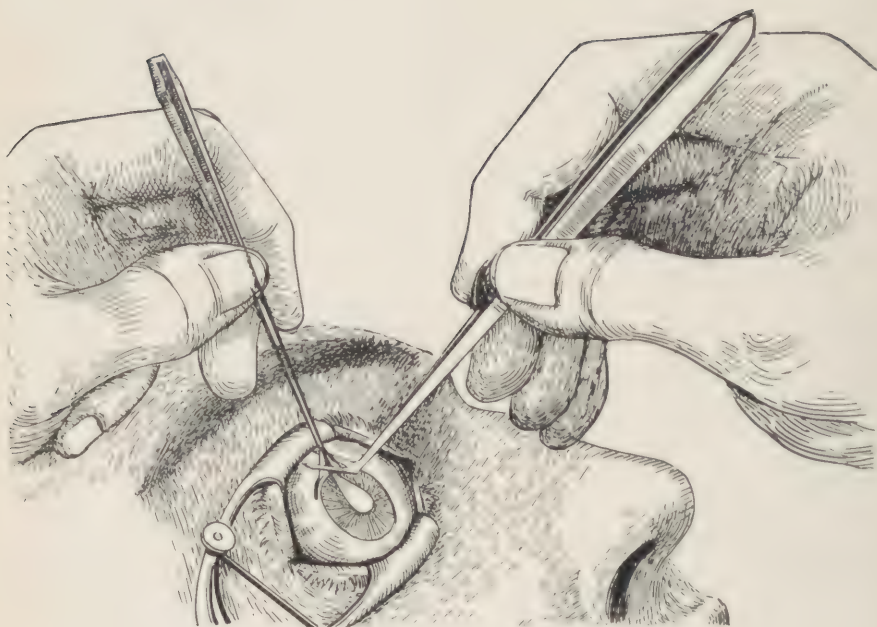


FIGURE 14

Very favorable position of hands in iridectomy upon right eye. Left hand supported by little finger on brow; right little finger in similar manner rests upon nose.—Author.

mentation, not to speak of the danger of infection of mild or severe grades to delay healing.

(3) Greater astigmatism results as compared with the purely corneal section he makes.

(4) Section is too far back for the primary safety of the eye; vitreous loss is more imminent at every stage of the operation where the section is well back in the endeavor to make a flap.

(5) Chronic irido-cyclitis and more or less permanent disaster occurs among some cases where limbus incisions and conjunctival flaps are made, but in the truly corneal section that he advocates such disaster is most rare.

I have entirely abandoned the use of the conjunctival flap and carry my incision only slightly into the conjunctiva or not at all.

The Section on Left Eye

When the surgeon is not ambidextrous the section upon the left eye will have to be made with the surgeon standing beside the patient instead of above his head. There is no particular disadvantage to this except that a few moments are lost in changing positions, preparatory to the completion of the operation.

The Iridectomy

The next step in the operation is the performance of the iridectomy. This is of great advantage and at this time few operators are omitting it. Without the iridectomy the iris is liable to prolapse during delivery of the lens and

resist all attempts to put it in place, or it may even prolapse and become engaged in the wound after the operation is complete, thus leading to the probability of the eye being lost. The technique of this step in the operation begins by gently insinuating the iris forceps between the lips of the wound, the eye being steadied by the fixation forcep applied to the conjunctiva as in the corneal section. If the iris forceps are applied without the eye being anchored with the fixation forceps in the hands of the assistant, a sudden turn of the eye upward may press the iris forceps against the upper lid and before the surgeon can prevent it the blades of the forcep may dislocate the lens. The iris is now grasped with the forcep and should be gently drawn upward out of the wound with the slightest possible amount of traction, and should be snipped off with the iris scissors.

Some operators are reverting to the old operation of linear extraction without iridectomy because of its cosmetic advantage. There is no argument against the claim that this operation leaves a more beautiful pupil than is obtained after an iridectomy is done but I question seriously if one is justified in eliminating the iridectomy. That there is more danger of subsequent prolapse of the iris into the corneal wound when the iridectomy is omitted is a fact beyond question, and as the prime object of the operation is vision and not appearance, this objection alone should be enough to condemn the method of extraction without iridectomy.

The disadvantages following an incarceration of the iris are well set forth by Casey Wood, as follows:

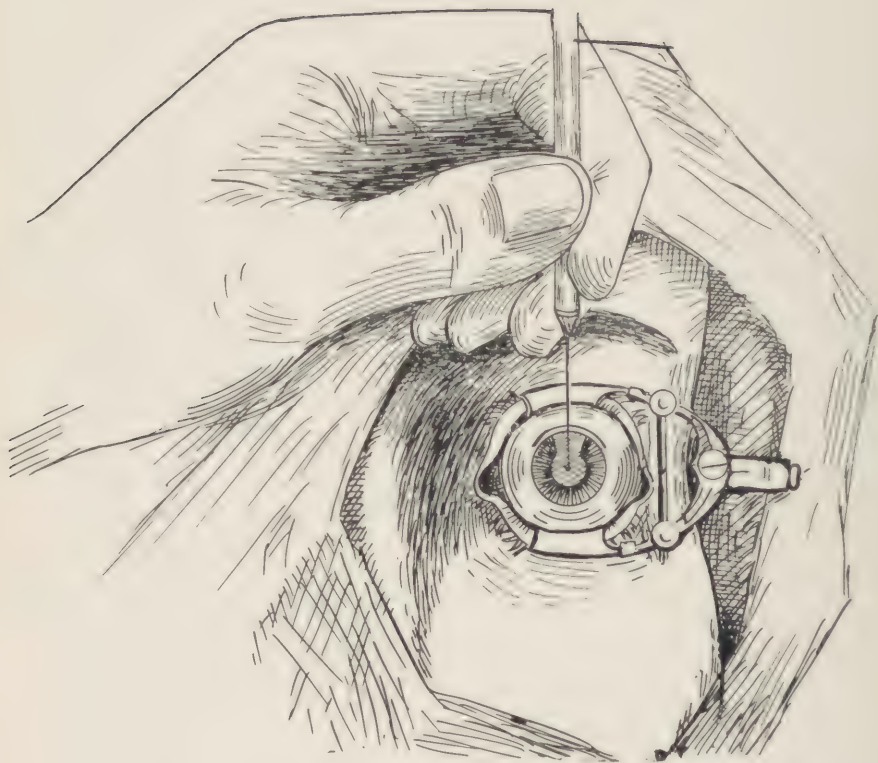


FIGURE 15

Frequently adopted but improper method of performing capsulotomy.—Author.

“A distorted and displaced pupil is a common sequel of an incarcerated iris. Not only is the pupil often drawn quite up to the half-formed scar (cystoid cicatrix) but its area is likely to more or less occluded from iritic deposits.

“Such a condition is a continual invitation to toxic and bacterial invasion of the intraocular tissues, and years after the operation uveitis and sympathetic ophthalmia may result from infection of the interior of the globe.

“Although a conjunctival covering is a hindrance to and may entirely prevent these evil consequences of prolapse and hernia of the iris yet it must not be forgotten that even after superficial healing has taken place the deep wound may be prevented from uniting and so admit a part of the iris between its lips. In such cases there is probably a foreign body (capsular fibril or cortical remnant) wedged in between the lips of the deep incision.

“If the hernia of the iris be wide a considerable amount of astigmatism is the result, and as this anomaly is likely to be of the irregular variety a serious interference with vision is certain to follow.

“To add to the discomforts of the patient the uneven surface of the globe prevents the lid edges from performing their proper cleansing functions, mucus, harboring bacteria and fouled with toxins, is insufficiently wiped off the eyeball and both conjunctival and ciliary irritation is a common consequence.

“The treatment of iris prolapse should precede that for secondary cataract, to avoid, as much as possible, loss of vitreous. If the prolapse be observed within the first twenty-four hours (when the great majority of them hap-

pen) the eye should be cocainized, thoroughly disinfected and an attempt made to replace the errant tissue with the stream from an irrigator or by means of a spatula. This reposition should be followed by the use of eserine and the question may well arise as to the advisability in the particular case of resorting to the conjunctival flap of Kuhnt.

“After the prolapse has assumed the condition of an actual incarceration, or has been exposed to external infection for several days, excision is the proper proceeding. The longer the interval between the prolapse and the operation the greater the difficulties to overcome. The wound is irritable, the eyeball tender and the iris congested; cocaine has little effect and neither fixation forceps nor speculum can be used for fear of vitreous loss. The eyeball and sac should be thoroughly irrigated with hot normal salt or boric solution, followed by the use of a few crystals of cocaine to the wound.”

The Incision in the Capsule

We are now ready to make our incision in the capsule preparatory to delivery of the lens. The free escape of the lens forward will only occur when this is done skillfully and thoroughly. The cystotome should be introduced into the anterior chamber with its cutting edge held parallel with the surface of the capsule, and after having been carried to the lower periphery of the lens it should be turned so that its cutting edge is against the surface of the capsule. The cystotome should then be drawn upward

until the upper margin of the lens is reached. I usually make a double incision in the capsule, which when finished resembles the letter X.

Usually, when the capsule has been sufficiently lacerated the lens will be seen to bulge slightly forward. Much depends upon the technique of this part of the operation. If the lens is pressed upon during the procedure it may break through posteriorly and be lost in the vitreous humor; or if it is the capsular incision that is not effectively made, the lens is apt to be dislocated backward while the attempt is being made to deliver it.

The technique of the incision in the Capsule is thus given by Fox.

"Each cataract," he says, "is surrounded by a pathologic capsule. This change may be invisible to the naked eye, or very much thickened and dense and easily detected by oblique illumination and yet it is very difficult to recognize the different types. Diaphanoscopy does not help us; oblique illumination may in some cases, but it is not to be relied on. The author has found that the age of the cataract and the senility of the individual are the best guides. A cataract of two years' growth has a capsule with a pale color, moderately dense in appearance, a cataract of three years' growth and over has a capsule of yellow cast, and is dense and inelastic. As the cataract matures the capsule thickens, while the zonule of Zinn, or suspensory ligament, grows thinner or degenerates. This classification of cataracts has been found on the whole fairly accurate. In rupturing the capsule of the lens, a modified Jaeger's cystotome is employed, it being con-

sidered much less dangerous than the ordinary straight cystotome that is in common use. The author follows the method adopted by Jaeger, making a rectangular opening in the anterior capsule. The instrument is passed into the anterior chamber, gently pressed against the cornea on the nasal side until it reaches the pupillary margin of the iris below, slightly turned backward and hooked into the capsule—then drawn upward toward the top, lacerating the capsule in its upward movement. It is again passed downward through this same opening, passing across horizontally until the iris boundary is again reached; a second vertical tear is made to the top across to the first incision. In this way, a rectangular opening of a large size is made in the anterior capsule. Pressure on the cystotome must of course be avoided, otherwise the lens may be dislocated.”

The Expulsion of the Lens

It is very probable that more accidents occur at this stage than during any other period of the operation. If the proper technique is not employed in delivery much harm may result and the eye may be lost. After the lens capsule has been sufficiently incised the surgeon places the spatula upon the lower portion of the cornea and makes slight pressure toward the center of the eyeball. As soon as the lens leaves its location the direction of this pressure is changed so as to be upward rather than backward. The pressure should be gentle and steady. Jerky movements with the spatula are apt to rupture the zonula and be at-



FIGURE 16

Method of making the incision in the anterior capsule preparatory to delivery of the lens. Demonstration upon model.—Author.

tended by a rapid loss of the vitreous or which is worse still, the lens may be dislocated backward into the vitreous. As the lens begins to glide upward into the corneal section its expulsion may be facilitated by a second spatula held under the corneal flap. Fisher, in a very ingenious manner pierces the protruding lens with a modified cataract needle, and with the aid of this instrument readily guides it through the opening in the cornea.

Should the lens remain stationary after the admissible degree of pressure is exerted it would indicate that the capsule had not been properly incised. In this exigency the anterior chamber will have to be re-entered by the cystotome, and the incision in the capsule be enlarged. Sometimes, when the anterior chamber is small and shallow, the corneal section will be found insufficient for the delivery of the lens, and in this case it must be carefully enlarged with the scissors. It is better to do this than to run the risk of disorganizing the lens by attempting to force it through an opening whose size is less than the diameter of the lens itself. Should this be attempted only the bulk of the lens will be expelled and a quantity of cortex matter will be left in the anterior chamber.

After the lens has been expelled the spatula may be pressed against the lower portion of the cornea, and with a number of upward sweeping motions the anterior chamber may be pretty well freed of particles of cortex which have been left behind.

“An idea of the completeness of the removal of the

cortex," says Geo. A. Berry, "may be got by seeing whether the patient can count fingers or not before applying the dressing. If this can readily be done, it shows that the pupil is clear. If the operation has been performed for an immature cataract, there may be some clear cortex remaining, but all opaque matter at all events has been removed from the line of vision. When this clearing has been made to a sufficient extent, or as far as may be advisable in any particular case, the spud should be run along the wound, in case any piece of capsule or cortex should be caught in the wound."

Should the vitreous begin to escape as the lens is being expressed the spatula should be put aside and an attempt at delivery of the lens be made with the lens hook. If the expression be continued while the vitreous is escaping it will only cause a fresh gush of vitreous without liberating the lens, and the eye may be lost.

Lavage of the Anterior Chamber

Some surgeons are in the habit of performing lavage of the anterior chamber. This, when successfully done, is of some advantage; but a number of dangers attend the procedure. With the cannula in the anterior chamber the patient is apt to flinch as soon as the solution is turned on, and the cannula be driven into the vitreous before it can be withdrawn. A flushing of the anterior chamber has, in many cases, been followed by violent iritis. Another disadvantage is that the returning flow, by coming in contact with the cilia, may cause an infection of the eye. In

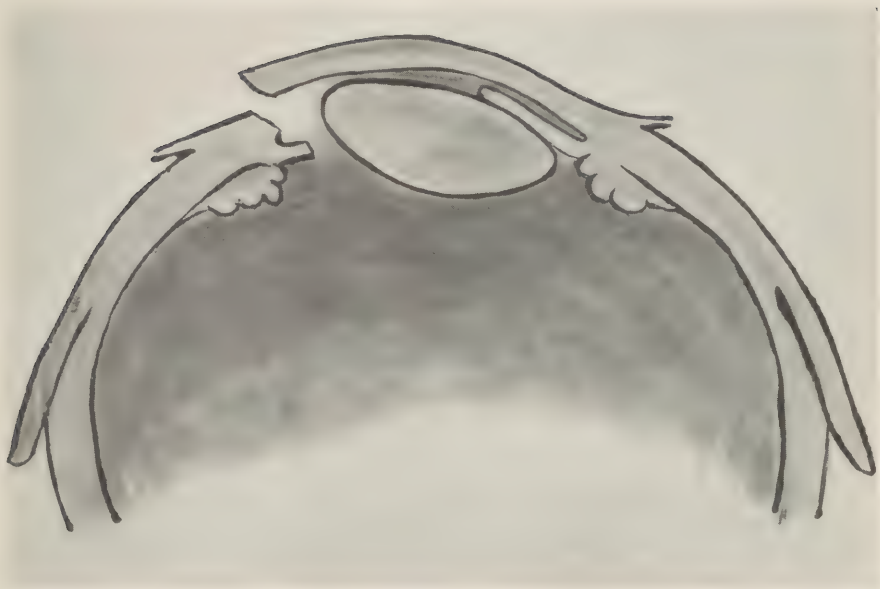


FIGURE 17

Showing route traversed by the crystalline lens in cataract extraction accompanied by iridectomy.—Author.

view of these and other untoward possibilities resulting from anterior chamber irrigation, I believe it is the part of conservation to omit the procedure entirely.

The Toilet of the Wound

The lens and cortex being removed, the thin end of the spatula is now passed along the corneal incision for the purpose of removing shreds of capsule and particles of cortex from the wound. Should any foreign matter be allowed to remain in the incision healing will be delayed and corneal fistula or violent iritis may result.

The toilet of the wound being complete the speculum may now be removed. The upper blade should be removed first. To accomplish this the patient should first be told to look down, and with the upper lid gently lifted the blade may now be disengaged and slipped out of its place. If the lid is not elevated before this is done the blade of the speculum may become engaged in the corneal wound.

The surgeon must watch carefully that no instrument used in the operation be allowed to touch the lashes. If this precaution be overlooked infection may ensue, for no amount of sterilization of the eye can insure the cilia being surgically clean.

Accidents during Delivery of the Lens

De Schweinitz gives the following accidents any of which may be looked for during the performance of a cataract extraction:

"1. The knife may be introduced with the cutting-edge turned in the wrong direction. If this somewhat inexcusable mistake should occur, the knife must be withdrawn and inserted properly. If this cannot be done, owing to the escape of the aqueous, postponement of the operation until the anterior chamber is refilled is necessary.

"2. The conjunctiva in the neighborhood of the counter-puncture may become distended with aqueous humor. This produces an elevation resembling a blab. The section should be completed as if the accident had not happened.

"3. The iris may fall before the knife. The incision should be completed in the ordinary way. An irregular coloboma will result which may be remedied by seizing the jagged edges with the iris forceps and trimming them with the scissors.

"4. Free hemorrhage may occur if a conjunctival flap is made or in performing the iridectomy. Under pressure the bleeding will sometimes cease, and the operator should then endeavor to get rid of the blood in the manner already described. If success does not follow the manoeuver, the cystotome must be introduced, even though everything is obscured by the blood, the capsule lacerated, and the lens expelled. During its expulsion sufficient blood will often come away to clear the pupillary space.

"5. The wound may be too small. This is a very unfortunate occurrence, and can be remedied only by enlarging the incision, which is best done with a small pair of probe-pointed scissors.

“6. Undue pressure of the cystotome may cause the lens to be partially or completely dislocated. If the dislocation is partial, the eyes should be closed and gentle pressure should be made with a bandage, when the lens probably will right itself and can be delivered. If the dislocation is complete and the lens slips back into the vitreous, it must be removed by means of the scoop or wire loop.

“7. The vitreous may escape before or after the expulsion of the lens. If before the expulsion of the lens, the operator should at once remove the cataract with the wire loop, which is gently inserted behind the lens. At the same time all pressure upon the eye must be removed. If vitreous escapes after the lens has been extracted, the wound should be cleared of protruding vitreous as gently and rapidly as possible and a bandage applied. Although escape of vitreous is an undesirable accident, its consequences are not always serious and good visual results may be obtained. If the escape of vitreous has been great, particularly if the vitreous is thin and there is tendency for the eyeball to collapse, a tepid, sterile, physiological salt solution should be injected into the vitreous chamber until the globe assumes its proper contour, as has been recommended by J. A. Andrews and Herman Knapp.

“8. Occasionally the corneal flap is everted because it has been caught by the margin of the lid, owing to a sudden movement of the patient. It must be replaced and a bandage quickly applied. Sometimes immediately at the conclusion of the section or directly after the deliv-

ery of the lens, especially in old and feeble subjects, there is great collapse of the cornea, which, instead of keeping its proper curve, looks like a wrinkled membrane. Under these circumstances the anterior chamber should be filled with physiologic salt solution, which will not only aid in making proper coaptation of the lips of the wound, but will prevent the sucking of the conjunctival juices which might lead to infection.

“9. Capsulotomy may not have been sufficient and pressure upon the inferior half of the cornea fails to cause the lens to present. In such a case the cystotome must be reintroduced and the laceration enlarged, or if the obstruction is due to the presence of a tenacious center in the capsule, this may be removed with capsule forceps.”

Immediate Accidents in Cataract Operation

A dislocation of the lens backward during an attempt at its removal is a most disastrous accident. Sometimes a lens thus lost in the vitreous may be lifted up and drawn into the anterior chamber with a wire loop, or it may, by special good fortune, be withdrawn with the small lens hook. Attempts at its removal should not be carried too far as too much churning of the vitreous will result disastrously. When this embarrassing predicament occurs it would be better, after brief attempts to remove the lens with the loop or hook, to bandage the eye with the hope that the lens will rise to its normal position, which it has frequently done following this accident, when it may be recovered by a secondary operation. If vitreous be lost



FIGURE 18

Supporting the lens with a wire loop during the act of delivery.
Demonstration upon model.—Author.

the eye should have a light pressure bandage to it but before it is dressed the section must be freed from incarcerated vitreous so that the wound will not gape.

In very shallow anterior chambers and in cases where much aqueous has escaped before the section is complete, the iris is apt to bulge forward and become entangled in the knife. This is a very awkward accident, which may make the withdrawal of the knife necessary. Under such circumstances it would be better to wait for the anterior chamber to refill than to proceed with the section. Should the latter attempt be made it would very certainly result in a disfigurement of the iris.

Dressing of the Eye following Extraction

The method so often seen of plastering the eye with sterile vaseline after the operation is to be discouraged. Vaseline becomes fluid at body temperature and, running along the lids, may enter the wound bearing contamination from the eyebrows, skin and lashes. If the cilia have been properly trimmed before the operation they will not adhere together and the vaseline is unnecessary. The eye should be first covered with a circular pad and this should be kept from crawling about over the face by anchoring it with two strips of adhesive plaster. These strips may be cut off with scissors at the first dressing instead of being pulled off, a procedure which may cause the patient to squeeze the lids together with a possibility of opening the corneal wound. Following the circular pad a gauze dressing is applied and is kept in place with a roller

bandage. Both eyes must be bandaged. If one eye is left free, even if the vision in it is slight, it will cause the patient to open his eye unconsciously from time to time, and may result in a gaping of the wound and a loss of the operated eye. Some surgeons are in favor of using a wire mask. This shield has some decided advantages. It may prevent the patient or nurse from carelessly thrusting a hand against the eye and causing the wound to gape or the iris to prolapse. On the other hand it is often objected to by the patient. If the shield is to be used the roller bandage will have to be left off.

Taking the Patient from the Table and Away from the Operating Room

The patient must be removed from the table to the ward carriage with the greatest care and only after having been instructed that he is not to attempt to help himself in the least. The carriage should be rolled cautiously and corners must be rounded slowly. This precaution, if not observed, may induce vomiting and be disastrous. It is better, if possible, to have the patient's room on the same floor as the operating room so that he will not have to be trundled in and out of an elevator. When the carriage reaches his room he may be drawn over upon the bed, being careful to avoid the general shaking up which so often accompanies this action, and be placed upon his back. He should be instructed to remain quietly as he is placed, and not to attempt to get out of bed under any circumstances.

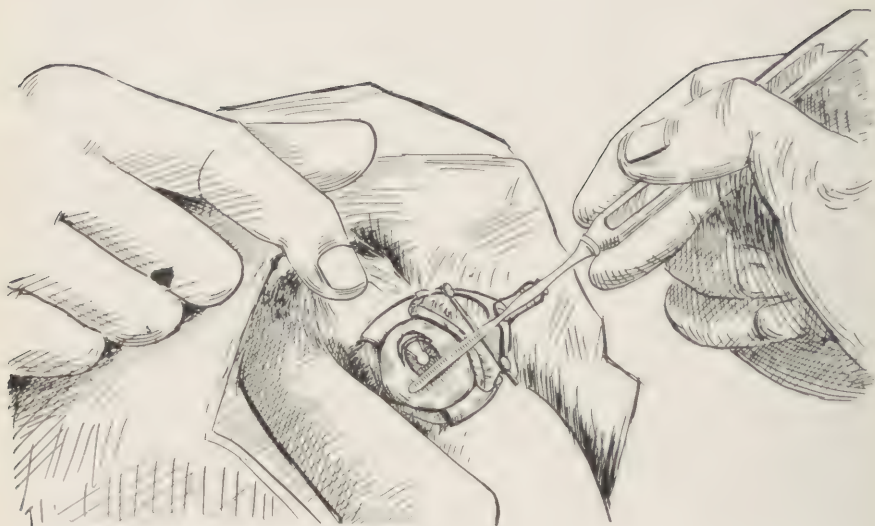


FIGURE 19

Unsuccessful method, adopted by some surgeons, of freeing anterior chamber of shreds of capsule and remnants of cortex and vitreous by use of spatula, while operator standing at right leans over patient. In addition to bad position lack of deep pressure from improper choice of instrument gives poor result. —Author.

For at least three days following the operation the use of the bed pan and urinal will be absolutely necessary.

The Patient's Room

The patient's room should be kept well shaded as an excess of light may cause irritation and pain in the eye. As good ventilation is necessary, the room need not be kept entirely dark. Usually a shade may be arranged at the patient's head to protect his eyes. Ample light may always be admitted, without doing any harm, to enable the nurse to move about the room freely. When the eye is first dressed the electric light should be dimmed leaving just enough light for the surgeon to work, and to conduct his examination.

Subsequent Dressing

The day after the operation, if the patient is resting comfortably, it may be permissible to defer the dressing of the eye until the following day. Some surgeons do not make the first dressing until the third or even the fourth day. This is not a conservative thing to do, for should anything of an untoward nature have happened in the meantime it may be too late to correct it. Thirty-six hours is sufficient time for an incision in an uncomplicated case to seal over and, at the expiration of this time, the eye may be inspected with comparative safety. Opening the eye sooner than this may be attended by a gush of aqueous and, when the simple operation has been done, a

prolapse of the iris and an incarceration of a portion of it in the wound.

Admission of light into the eye should be gradual and for this reason it is unwise to attempt to test the vision at the first dressing.

After the initial dressing has been made the eye should have attention daily. Following an uncomplicated operation the corneal wound is sealed in a very brief period. As early as twenty-four hours after the operation the wound closure may be complete and the aqueous be so nearly reformed that the anterior chamber appears to be of normal depth.

If the lids are not puffed and if the secretion be scant very little should be done. I believe the practice of daily dropping solutions into the eye, when no complication exists, is a bad one as it causes annoying irritation without accomplishing any good. The margins of the lids may be gently mopped with sterile gauze moistened with boric acid solution, and even this should be practiced with great care so as not to carry infection into the eye.

Patients are often startled by the lids filling up with tears which, after a time, gush suddenly from the eye. It is always well to explain to the patient that he may have this experience, thereby protecting him from unnecessary alarm.

Postoperative Prolapse of the Iris

This may occur in cases when the simple operation has been done. Usually the fault lies with the corneal wound



FIGURE 20

Removing fragment of cortex from the anterior chamber by deep stroking of the cornea. Demonstration upon model.—Author.

which gapes before healing is complete. If the section permanently gapes this may be a beneficial accident, the iris helping to close a wound that otherwise would remain open and admit infection. The process is the same as that employed by nature in other penetrating wounds of the cornea where the iris is pushed forward to help seal over the opening. When a prolapse occurs very soon after the operation, the iris should be replaced; but when it occurs in wounds that show a disposition not to heal, it is better to leave the eye alone. I have seen two cases, each with very good vision, in which this accident had happened.

Postoperative Intra-Ocular Hemorrhage

This complication, which invariably ends in complete destruction of vision, is thought always to be preceded by some disease of the choroid.

Treatment of Postoperative Intra-Ocular Hemorrhage

While the condition leaves no hope as far as vision is concerned, a lavage of the anterior chamber with a view to removing the clots and allowing the corneal wound to close may prevent the necessity of an enucleation. Fortunately, this accident is very rare.

Postoperative Glaucoma

This complication is usually ushered in with pain which radiates along the branches of the fifth nerve. Unlike the periodic pain of iritis, the pain from glaucoma is constant. The iris is seen to push forward and the cornea becomes steamy and is insensitive. There is a deep injection of the conjunctiva which is general instead of peri-corneal as in iritis. If the combined operation has not been done, an iridectomy is indicated at once. Otherwise, eserine or pilocarpin may be used and may arrest the process.

Postoperative Iritis

This may present itself from the third to the tenth day. The initial symptom is pain, severe and lacerating, but periodic. It is usually very pronounced during the early morning hours. The iris becomes swollen and the pupil shows a tendency to contract. The cornea has a hazy appearance, due to its posterior surface being studded with deposits. There is deep pericorneal injection and a very profuse lachrymation.

Treatment of Postoperative Iritis

The treatment of this condition should be both local and systemic. Free purgation should be instituted and the salicylates should be administered. Hot applications should be applied to the eye and a one per cent. or stronger solution of atropine should be dropped in the eye four or five times a day. The patient should be kept in bed.

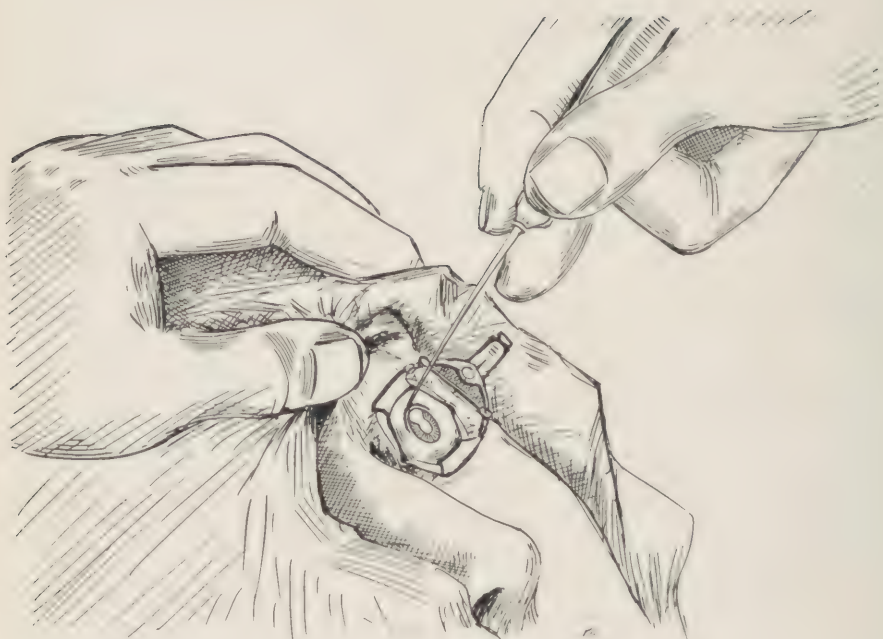


FIGURE 21

Very frequently assumed but awkward position of hand in performing toilet of the wound. As will be observed the hand is entirely unsupported. Author.

Suppuration of the Corneal Wound

Suppuration of the corneal wound may occur any time from the second day till the fifth or sixth day. It is usually ushered in with a feeling of pain, described as something sticking into the eye. In rarely fortunate cases the infection may be confined to the anterior chamber and may subside in a few days, leaving very little bad results; usually, however, the suppurative process increases in severity, pain is intense, the lids become greatly swollen, the corneal flap undergoes a sloughing process, and the eye is hopelessly wrecked.

Treatment of Suppuration of the Wound

During the last year or two Dakin's solution has been used as an irrigation with some success. Formerly lavage with a 1-2000 bichloride of mercury was suggested and is still used by some surgeons. Sub-conjunctival injections of normal salt solutions have been much lauded. Regardless of treatment, nearly all infected eyes are lost.

Non-Union of the Corneal Wound

One of the most serious postoperative complications of cataract extraction is non-union of the corneal wound. This sometimes occurs in very old and debilitated patients or it may result from no apparent cause in patients previously looked upon as splendid operative risks. Frequently some mechanical cause, such as tags of iris or shreds from the capsule, may be found responsible for

non-union of the wound. Mueller believes that corneal epithelium, scraped into the incision by the spatula, may in some cases be responsible for a failure of the edges of the wound to unite.

Treatment of Non-Union of the Cornea

It is doubtful if meddling surgery will do otherwise than be productive of bad results. The wound should be kept sterile. Atropin should be dropped in the eye once or twice a day, and a bandage should be gently applied. Care should be exercised in the application of the dressings. If they are too firmly applied they will only add to the gaping of the wound. The patient must be kept in bed and be well nourished.

Mental Complications

Acute insanity may be a complication of cataract extraction. Aside from the fact that this unfortunate sequel may leave lasting results it is liable to end in disaster to the eye, for during an unguarded moment, the bandage may be torn off and the eye infected, or the violent struggles of the patient may end in a reopening of the wound and an expulsion of the contents of the globe.

Postoperative Pain

A considerable proportion of cataract extractions are followed by a certain amount of pain or at least a sense

of uneasiness in the operated eye, ranging all the way from a slight smarting sensation, to pain more or less acute. This discomfort usually subsides after a few hours, leaving no bad result. The nurse should be cautioned not to administer an analgesic by mouth to a cataract case. Several years ago I had a patient lose an eye from violent vomiting brought about by the administration of a powder containing aspirin and Dover's powder, given by a sympathetic pupil nurse who acted upon her own initiative. If the uneasiness in the eye is sufficiently severe to cause the patient to be restless an opiate may be given hypodermically.

Diet and General Care of Patient

The majority of surgeons restrict their cataract patients' diet to liquid for several days following the operation. It seems to me that this is an unnecessary precaution and a mistake. The muscles controlling mastication are in no way associated with the eye and because of this fact it is difficult to believe that the act of chewing can be productive of harm. Patients, especially elderly ones, who are put through a process of semi-starvation rapidly lose strength and vigor, and the healing process in the cornea may be delayed thereby. I have found that semi-solid food, carefully selected and prepared, is not contraindicated in any way and that patients thus fed do better than do those confined to the liquid diets, which I formerly prescribed.

The patient's bowels should have the closest attention.

If he fails to have bowel movements the first and second day following the operation enemata should be administered. After the third day moderate doses of cascara may be given, the size of the dose depending upon the degree of constipation. As stated in a previous chapter, the bed pan is absolutely essential for the first three or four days.

Aphakia

Removal of the crystalline lens produces a result which is technically known as aphakia, and which can only be corrected by convex lenses. Providing that the patient has not previously been myopic, ten or more diopters correction will usually be necessary. In addition to the high degree of aphakic hyperopia an astigmatism of three or four diopters, "against the rule" is apt to be present. The eyes should not be fitted, however, until all symptoms associated with the extraction are absent. The patient should be provided with two pairs of glasses; one pair for distance and a pair for reading which usually must be three diopters or more in advance of his distance correction.

End of Results of Cataract Extractions

A great variety of opinions exist in reference to the degree of vision, with correcting lenses, that must be obtained before a cataract operation may be classified as a success. Statistics regarding the percentage of successes made by men of established reputation vary to a remark-



FIGURE 22

The toilet of the wound: Freeing the incision of shreds of capsule or fragments of cortex or vitreous. Demonstration upon model.—Author.

able degree. A well known American surgeon recently reported a series of one hundred cataract extractions, ninety-five of which were tabulated as successful. Among these one-eighth were said to have vision of 20-20. Without presuming to question the authenticity of this report I am taking the liberty of quoting the following opinion given by De Schweinitz of Philadelphia, in his book: *Diseases of the Eye*.

"Perfect acuity of sight," he states "is frequently secured 20-20, but more often patients must be content with lower degrees, $\frac{1}{8}$ or according to some operators 1-10 of normal vision being sufficient to place the case within the category of success."

Ball considers vision of 20-20 to be a good result and vision from 1-200 to 18-200 to be a moderate result. This classification is conservative and is probably more nearly borne out by the experience of American surgeons than any other.

Congenital or Juvenile Cataracts

Rarely do children develop cataracts in early childhood that are not of congenital origin. When they are discovered in early life they may be looked upon as accentuations of opacities which existed at birth rather than as recent developments. A slight haziness of the lens may be entirely overlooked in infancy, the disturbance of vision which it causes being attributed to "near sight." It is only after the child begins to read, that the defect manifests itself.

A small per cent. of cataractous children are born with their lenticular opacities complete. These opacities may be capsular or nuclear. More frequently the opacities are partial, the child reaching puberty before the stage of even partial blindness is reached.

Congenital cataracts are usually divided into six types:

(1) Central or nuclear type, similar in appearance to the beginning nuclear cataract of senile life.

(2) Lamellar type, in which the opacities are in the layers of the lens between the nucleus and cortex.

(3) Anterior polar cataracts, usually due to pupillary adhesions to the anterior capsule.

(4) Posterior polar cataract, thought to be occasioned by a persistent hyaloid artery.

(5) Punctate cataracts, which are very rarely observed.

(6) Axial cataracts in which the opacity extends through the lens of its axis, from the anterior to the posterior portion.

Diagnosis of Juvenile Cataract

The diagnosis of juvenile cataract is based upon the same clinical observations that apply to the senile variety. The lens, however, may have a hue different from the mature type and may present a bluish white rather than a grey appearance.

Treatment of Juvenile Cataract

In cases of juvenile cataract, when little interference with vision occurs, the child may be fitted with lenses cor-



FIGURE 23

Proper method of applying cataract bandage.

recting refractive errors, and the case may be let alone. If there is much disturbance of vision operation is indicated.

Selection of Operation

Three different operations may be performed for congenital opacities of the lens, the character of operation best suited to the individual case being the one that should be selected. These operations are discission, iridectomy and expression. In the punctate variety an iridectomy will usually suffice. It would be the height of poor judgment to needle or express a lens of this type and create all the disadvantages that are associated with an aphakic eye when an iridectomy will uncover sufficient clear lens tissue to establish vision. In nearly all the other types of early cataract the operation for solution is indicated.

Operation for Solution of Juvenile Cataract

This is performed by puncturing the lens and admitting the aqueous humor to it. By the macerating influence of the aqueous, the lens tissue rapidly disintegrates and disappears. Before attempting this operation the pupil should be widely dilated with atropin. The patient must be under a general anesthetic.

With the speculum in place a knife needle, either straight or curved, is thrust through the cornea at the sclero-corneal margin, and carried to the anterior pole of the lens. With much nicety it must now be made to divide

the anterior capsule. If this portion of the operation is not done with extreme care the lens may be dislocated backward into the vitreous where it will act as a foreign body and may result in loss of the eye. For this reason the needle must not be carried too deeply into the lens tissue, and its motion must be restricted. The less leverage given it the better, and if the lens is seen to move in the slightest degree the needle should be at once withdrawn.

Another reason for not producing too much mechanical disturbance to the lens is that lens tissue so treated swells greatly and consequent pressure upon the iris may give origin to adhesions between it and the capsule, which may be broken up with difficulty or not at all.

Frequently flocculent portions of the lens may escape into the anterior chamber, where they are usually absorbed without any disturbance. In rare instances, however, lens materials in the anterior chamber may give rise to violent symptoms of pain, inflammation and vomiting. When this unfortunate condition is met with, the cornea must be incised and the lens material swept out in much the same way that the cortex is removed following an extraction of senile cataract.

Nuclei of cataracts falling into the anterior chamber late in the treatment, the result of absorption of the surrounding lens tissue, usually do not create the disturbance which is seen when the cortex matter so invades the chamber. Usually nuclei thus displaced may remain several days or weeks before disappearing, their position not being attended with any bad results.



FIGURE 24

The woven wire cataract shield of Würdemann.

The Double Needle Operation for Juvenile Cataract

Dilaceration, or the double needle operation, is the one favored for juvenile cataract by a small per cent. of surgeons. In performing this operation one needle is entered at the outer side of the cornea and is carried obliquely inward until it is seen to pierce the capsule. Another needle is now introduced at an opposite point in the cornea and is also carried through the capsule, after which the handles of both instruments are elevated, this manœuvre separating the blades simultaneously, thus tearing an opening in the capsule.

When the capsule is very thick and dense the operation for extraction of the capsule is indicated. A good hold is taken upon the conjunctiva with the fixation forceps and an incision is made in the cornea similar to the initial section, except that it should be less extensive and should be carried through the capsule at a point opposite its entrance.

After Treatment of Juvenile Cataract

The pupil must be kept dilated for several days following a needling of the lens. Usually very slight inflammation occurs subsequent to this operation when it is well executed, but it is well to keep the child in bed for a day or two.

The operation may have to be repeated several times before all lens matter disappears; but, as a general rule, if a sufficient time elapses between the needlings, the case will not have to undergo more than two or three operations.

When solution is complete an artificial lens having the refraction value of the crystalline lens just removed must be fitted and constantly worn.

The operation for solution is readily performed by any one who has the least aptitude for surgery. In cases of soft cataract the results are fully as good as when expression is done, and the operation is not attended with the danger associated with a corneal section. In my opinion, expression for juvenile cataracts is a procedure to be condemned unless the circumstances surrounding the case are unusual.

The Suction Operation for Juvenile Cataracts

A very popular operation, a few years ago, for juvenile cataract was that of suction. This method is very graphically described by Haynes Walton, as follows:

Suitable Cases for Suction Operation

“All full-bodied complete cataracts in persons under the age of forty. Herein are included cataracts spontaneously formed; diabetic cataracts, a most favorable class; traumatic cataracts, in which, from the rent in the capsule being of moderate extent, the eye remains quiescent until the cataracts is entirely developed; in complete cataracts, which have been rendered complete by the careful puncturing of the anterior capsule.



FIGURE 25

Method of applying the binocular convex cataract shield.

Unsuitable Cases

“Incomplete or immature cataracts, in which portions are transparent and glutinous, and would require great suction force to draw them into the curette; traumatic cataracts in which the eye is in a state of excitement, or involved in iritis or where there has been rupture of the posterior capsule, or in which from lapse of time the bulk of the cataract has been so far reduced that the anterior and posterior capsules are almost in contact. Cataracts which are congenital, or have formed in early life, or are of traumatic origin, and have undergone wasting and calcareous degeneration.

Instrument and Its Use

“The glass stem, five inches in length, allows the operator to watch the progress of the suction. The India rubber tube, eleven inches in length, and furnished with a mouth-piece, allows the operator to apply the suction either with considerable force, or with the most exquisite gentleness, and to use his tongue as a piston under the most perfect control.

“The tubular curette is the most critical portion of the instrument, and the one in which deviations from a correct form are most liable to lead to disappointment. My original idea was taken from the old-fashioned curette used in flap extractions. This was roofed in so as to form a tube with a small opening near its extremity. In size and curve, the original was all that could be desired, but it has been improved by being shortened to five-eighths of an

inch, and by being slightly convex on its upper surface, instead of being flat, the whole calibre occupying an opening in the cornea no larger than would be required for the common curette. The point should be as round and blunt as possible, and the opening in the upper surface should be in size equal to the section of the tube, and as near to the extremity as the required bluntness will permit. In order to facilitate the access of the lenticular matter to the opening in the curette, side notches were made in the margin of the aperture, thus defeating the cardinal point of safety, that the cornea should act as a stop-valve, when drawn down upon the flat margin of the orifice, and defend the iris and eye from the dangerous effects of prolonged suction. For a short period I used such an instrument, and was annoyed by the difficulty of avoiding injury to the iris.

Details of the Operation, First Stage

“The pupil having been well dilated by atropin, and the eyelids fixed by the wire retractor, the eyeball should be steadied by conjunctival forceps in the left hand of the operator, whilst the opening in the cornea is made by a needle of sufficient width held in his right hand. The needle should enter the cornea at a point opposite the margin of the fully dilated iris, and passing obliquely through the substance of the cornea, should enter the anterior chamber at a point opposite to the margin of the pupil when of medium size. Such a valvular opening will provide that there is no scar in front of the pupil; that the wound is not so near to the attached margin of the iris, as to favour prolapse of

the iris or adhesion of it to the corneal wound, and that the curette may not, when introduced, rest on or bruise the iris.

Second Stage. Efficient Rupture of the Anterior Capsule

“This is, perhaps, the most difficult and important part of the operation. Sometimes Mr. Teale tears the capsule by two needles before making the opening in the cornea. On the whole, however, he thinks the best method is to effect a free opening with Graefe’s cystotome passed through the opening made by the broad needle, care being taken to carry the instrument to the opposite edge of the pupil before making any breach in the capsule, for the simple reason that the object of this step is not merely to liberate the cataract, but also to insure such a tearing up of the anterior capsule that it may curl back from the area of the pupil and be lodged behind the iris. At the same time he endeavors to avoid injuring the posterior capsule, a caution to be especially borne in mind in those cases in which the anterior capsule is tough, and in traumatic cataracts, in which the lens has been much reduced in bulk by absorption.

Third Stage. The Removal of the Cataract by Suction

“The operator carefully introducing the curette through the corneal wound, the eye being still fixed by the conjunctival forceps, should steadily hold it with the opening look-

ing up towards the cornea, in the area of the pupil, and gently bury it in the opaque material, by pressing the convex surface, not the point, backwards towards the posterior capsule. The suction power should then be carefully applied, and continued gently as long as opaque matter comes forward into the pupil. When all is clear, the curette may be withdrawn, and the eye gently rubbed through the upper eyelid, which will bring into the pupil any remains of cataract that may have been lodged behind the iris. The curette must on no account be swept either in front or behind the iris in search of portions of cataract. If the suction be continued after the cataract has been removed, the cornea is drawn upon the opening in the curette, blocks it up, and thereby arrests the suction before the iris can be drawn into the tube and so injured. In the more tenacious forms of cataract, considerable suction power must be exerted.

General Conclusions

“If the operations have been efficiently performed, it will be found that the cataract has been completely withdrawn from the eye through an opening no larger than would be required by the common curette, without rupture of the posterior capsule, and with such complete division of the anterior capsule that it has disappeared completely behind the iris. It will also be found in such cases that recovery is most speedy, that the operation is followed by little or no irritation of the eye, that the patient in a week or less can read No. 1, Jaeger, and that the conditions which



FIGURE 26

Densest form of secondary cataract resulting from the agglutination together of the anterior and posterior opaque capsules.—Author.

usually produce opacity of capsule, and demand secondary operations, have been guarded against. In one of my cases, the patient could read No. 1, Jaeger, immediately after the operation. Several others have been so well on the third or fourth day that they could return home into the country. Very few cases have required secondary operation for opaque capsule. I have rarely seen the operation followed by destructive inflammation never as far as I can remember where the cataract, on the posterior capsule, has been in good condition.

“I am firmly convinced that within certain limits extraction by suction can be made more certain, more speedy and more brilliant than any other mode of removal of cataract, and that we are now in a position to define those limits with tolerable accuracy.”

Traumatic Cataract

Traumatic cataract, as indicated by its name, results usually from a penetration of the lens substance from some flying missile, or from a blow of sufficient force to rupture the capsule of the lens, either anteriorly or posteriorly. Injuries to the crystalline lens from penetrating wounds resulting from sharp instruments are usually attended with pain, swelling and photophobia. If these symptoms subside without infection of the wound and loss of the eye a cataract results. Following a rupture of the capsule a cataract may develop without any untoward symptoms, and the vision be lost for weeks or even months before the cataract is discovered.

Injury to the crystalline lens occurring in adult life is of greater significance than similar accidents among juveniles. If the lens is severely injured glaucomatous symptoms may present themselves in a few hours, giving rise to the necessity for operation. It is better, under the circumstances, to extract the lens through a linear incision in the cornea, preceded by a broad iridectomy. Secondary or capsular cataract, which may follow this procedure, is to be dealt with in the same manner as that suggested for the relief of capsular cataract occurring after senile lens extractions.

Treatment of Traumatic Cataract

In children with traumatic cataract, solution often takes place, this being due to the disintegrative action of the aqueous upon lens tissue. The greater the rent in the capsule and the younger the patient, the more rapid will be the absorption of the lens. In young children whose lens capsules have been injured, but who have not suffered a penetrating wound of the globe, nothing should be done to the eye except to dilate the pupil. When the rupture of the capsule is associated with a penetrating wound from some sharp instrument, in addition to atropinization, the eye should be sterilized and dressed.

Dislocation of the Crystalline Lens

Dislocation of the crystalline lens forward or backward may be associated with a rupture of the capsule. Not in-



FIGURE 27

The double needle procedure adapted to discission of dense secondary cataracts.
Demonstration upon model.—Author.

frequently the lens is dislocated in its capsule and is extruded between the conjunctiva and the sclera or is lodged under the capsule or tenon. These accidents, not coming under the classification of true cataract, will not be further considered here.

Secondary Cataract

In a great proportion of cases in which a cataract has been removed a later operation upon the capsule will be found necessary. Fox states that, when capsulotomy has not been performed at the time of extraction of the cataractous lens, at least twenty-five per cent. of cases will develop opacities in the remaining capsule. The percentage of these cases will be found to depend largely upon the degree of maturity of the extracted lens, and the amount of cortical matter that was left behind at the time the lens was delivered. If much lens matter has been allowed to remain in the anterior chamber secondary cataract may be looked for in almost every case.

Operations for Secondary Cataract

A number of surgical methods have been devised for attaining increased acuity of vision in cases of after cataract. Of these discission, or the cutting operation, is most in vogue; due to the ease with which it is accomplished, and because of the comparative safety attending its performance. In this operation the knife needle should be used, for the capsule must be clearly incised without any

unnecessary dragging upon the ciliary muscle. The pupil should be thoroughly dilated, the eye cocainized and the knife needle inserted at the limbus, the exact point of entrance to be governed by the character and density of the capsule. After the instrument enters the anterior chamber it should be carried obliquely inward to a point as far opposite to its point of entrance as the iris will permit. Its cutting edge is then directed toward the point of entrance so that in raising the handle it will cut its way through the membrane. If the cut is clearly made, and if it is sufficiently long, the elasticity with which the capsule is endowed will cause it to gape, thereby creating a permanent opening in the capsule.

Extraction of the Capsule in Secondary Cataract

In performing this operation a small corneal section is made. A five or six millimeters incision is usually sufficiently long to admit the capsule forcep, which is now introduced into the anterior chamber. The capsule is grasped by it, drawn out and snipped off. It is important, during this step of the operation, not to produce too much dragging upon the ciliary body, else an iritis or an iridocyclitis may result. Operations upon the capsule should not be attempted without the aid of a reflected light sufficiently brilliant to enable the surgeon to obtain a good view of the capsule.

Following the operation for secondary cataract the patient should be confined to his bed for forty-eight hours, after which time he may be about the room. The eye

should be dressed daily and be protected from the light until all untoward symptoms disappear.

The Intracapsular or Indian Operation

The technique of the intracapsular operation does not differ materially from the classical extraction as done by the European and American surgeon except in the method of expulsion of the lens and the character of the incision. Colonel Smith makes his corneal section in the usual manner, but its base is much broader and the conjunctival flap is invariably omitted. The technique of extractions in the unruptured capsule is described by Smith as follows:

“When the incision is finished and the iridectomy performed (if the operator decides to do one) the speculum is removed, and the operator proceeds without speaking to the patient. In the case of an immature lens or of a hard cataract, with a spatula in the operator’s left hand for use if required, he proceeds to press back with the point of a strabismus hook towards the optic nerve, the point of the hook being placed over the lower third of the cornea. The pressure is steady and the point of the hook should not be moved until the upper edge of the lens tilts forward and is thus seen to be dislocated, having been made to swing round on its transverse axis. The moment the lens is seen to be dislocated, the pressure through the point of the hook is gradually turned more and more towards the wound, pressure being maintained all the time so as to keep the lens up to the sclerotic margin, the pressure with the hook becoming gradually lighter and lighter and the hook

gradually sliding after the lens until the cornea is folded beneath it. At this stage it is delivered. In a low tension eye the beginner should follow up the lens with the spatula in addition to the hook, as with it he can maintain a sufficient tension in the eye and thus allow his right hand instrument to follow up the lens more lightly. In rare cases of low tension eyes he might find it advantageous when the lens is half way out to apply a little counter-pressure above the wound with the spatula. In the case of intumescent lenses and Morgagnian cataract (in which the nucleus is small and is surrounded by a considerable amount of soft disintegrated lens matter) the capsule is generally extremely delicate and if dislocated in the manner above described, is liable to burst when the lens is half way out, allowing the nucleus to escape and to be itself retracted with considerable amount of lens matter. The operator is then placed in a difficult position, the capsule being dislocated at the wound. To overcome this I observed that lenses of this class occasionally turn a half somersault, dislocating opposite the wound, and that having done so, the capsule very seldom bursts and when it did burst it was attached only in the neighborhood of the wound and was not drawn back, and that under these conditions it was very easily caught with a pair of dissecting forceps and removed entirely without inserting any instrument into the eye. I proceeded to imitate this accident with this class of cataracts, first by applying pressure over the ciliary region, but soon desisted as I had a few cases of expulsive hemorrhage from choroidal detachment, which I attributed to my manipulation of this region. I then com-



FIGURE 28

Discission of the opaque capsule as performed where single Von Graefe knife is used. Demonstration upon model.—Author.

menced to press with the point of the strabismus hook sufficiently deep over the lower border of the lens. I then found I could almost invariably make these lenses dislocate below and then turn a half somersault. This pressure and traction are always over the zonule.

“As soon as the lens turns up into the wound, showing that it is freely dislocated below, the operator should cease to make traction toward the patient’s feet but make direct pressure backwards, then backwards and upwards and, finally, more and more towards the wound, folding the cornea beneath the lens until it falls on the outside of the cornea. At this stage the capsule has not been dislocated from the zonula in the neighborhood of the wound. The hollow of the curve of the strabismus hook should now be made to sweep along between the lens and the wound to complete the detachment. The beginner, while using the hook thus, would do well in all instances to put the spatula on the cornea so as to keep up sufficient tension in the eye and so prevent the lens from slipping back into the eye in this latter stage whether it be of hard or of soft consistency, since a lens is occasionally liable in this stage to slip back into the eye and then to be exceedingly difficult to remove.

“The hypermature cataract is, of all cataracts the most difficult to dislocate. It has become shrunken, its capsule thickened, and its attachments have become firmer than is the case with any other senile cataracts. The operator in this case should proceed with the strabismus hook as in the case of immature and hard cataract. The spatula in his left hand should be in position at the margin of the wound

to drop behind the lens the instant the edge of it is seen at the wound, as otherwise pressure on the cornea will only squeeze out vitreous, the lens refusing to move. It should be dropped almost straight down into the eye, the back of it being kept thoroughly against the sclerotic margin of the wound. The lens should be pressed against it with the hook from the outside and thus made to slide up along the inclined plane of the spatula. The spatula should be kept steady in position, care being taken to not use it as a means of lifting out the lens. If used to lift out the lens, the capsule is very liable to be ruptured and vitreous escape behind it at the same time. It does not require to be inserted behind the lens to more than a trifling distance; it is thus used to prevent the pressure from the hook on the outside from putting objectionable pressure on the vitreous. The spatula for this purpose should have a slight curve and be about $7/16$ inches broad and not sharp anywhere, so as to avoid the risk of injury to the capsule. A dextrous operator, if he follows these directions and the patient being fairly well behaved, will be able to extract hypermature cataracts thus with escape of vitreous in a trifling percentage of cases. I believe that hypermature cataract is infinitely more common in India than in America or Europe, as in these countries patients have their cataracts extracted before they reach this advanced stage.

There is one other variety of cataract worthy of mention. It is a rare form, the color of coarse white soap, a characteristic color when once seen. It is exceedingly difficult to dislocate and when recognized the operator should proceed as in the case of hypermature cataract.



FIGURE 29

Bandage well adapted to discission cases.

"The iris being a sticky membrane, is found, after the lens is extracted in capsule, sticking to the sclerotic and in angles of the wound. Whether an iridectomy has been done or not its careful reposition in this operation is of the utmost importance. The assistant firmly holding up the eyelids and brows as before, it will be observed that the cornea drops back and that the iris, not in the neighborhood of the wound, falls on the vitreous leaving the aqueous chamber and the space which the lens occupied vacant. With a suitable repositor the operator should release the remaining parts of the iris from the sclerotic and from the angles of the wound. When this is properly done the operator is able to see back to the very base of the iris all round in the neighborhood of the wound. There need be no hurry about the reposition of the iris. It can and should be done with the utmost care. If this is done and the eye carefully dressed and not redressed until after the eighth day, and the patient behaves sensibly, iris prolapse will seldom be seen. Complications of the iris in the wound are generally due to not replacing it properly and to meddling dressings and meddling inspections and foolish conduct on the part of the patient.

"If vitreous escapes it should be snipped off with scissors and not left hanging in the wound where it will act as a drain preventing union. As iritis, iridocyclitis and sepsis are so exceedingly rare following this operation, the after treatment is almost nil. Atropin is not necessary."

That the Indian operation is not well adapted to the Occident is suggested by the following extract from Tif-

fany's criticism of the method which would indicate that even the Indian surgeons recognized its limitations.

"Colonel Maynard told me that he operated for some time in conjunction with Colonel Smith, and that he now makes the intracapsular operation in about 30 per cent. of his cataract cases. He thought that the intracapsular method is well adapted to hypermature cataracts, and said that most of the Indians do not seek surgical advice until the cataract is over-ripe. He added that it had been his experience to find that hypermature cataract frequently presented itself as soon as the incision was made, and that consequently we might all of us occasionally extract the lens with the capsule intact. Colonel Maynard said that in his opinion the operation is not at all adapted to European or American cases; and that if he were practicing ophthalmology in Europe, he certainly would not use this method in his private practice. He felt that it involves too great danger of loss of vitreous, and subsequent deterioration of the globe; for he was not of Smith's opinion that the vitreous is restored."

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